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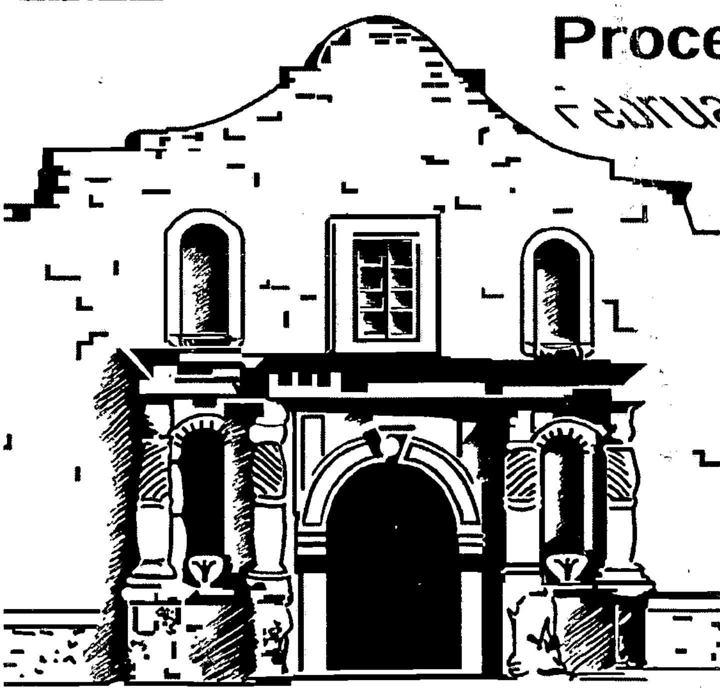
ABSTRACT

This proceedings contains the papers presented at SITE 99, the 10th annual international conference of the Society for Information Technology & Teacher Education. Papers are listed under the following headings: "Concepts and Procedures" (24 papers); "Distance Education" (44 papers); "Diversity" (12 papers); "Educational Computing Course" (12 papers); "Educational Leadership" (18 papers); "Faculty Development" (23 papers); "Graduate & Inservice" (34 papers); "Instructional Design" (23 papers); "International" (9 papers); "Mathematics" (18 papers); "New Media" (19 papers); "Preservice Teacher Education" (27 papers); "Reading, Language Arts & Literacy" (14 papers); "Research" (38 papers); "Science" (4 papers); "Simulations" (5 papers); "Social Studies" (4 papers); "Special Needs" (7 papers); "Technology Diffusion" (29 papers); "Telecommunications: Graduate & Inservice" (11 papers); "Telecommunications: Preservice Applications" (9 papers); "Telecommunications: Systems & Services" (15 papers); "Theory" (11 papers); "Young Child" (4 papers). (AEF)

SOCIETY FOR INFORMATION TECHNOLOGY & TEACHER EDUCATION 99

10th International Conference



Proceedings of SITE 99–

February 28-March 4, 1999

San Antonio, Texas

General Editors –

Jerry D. Price
Jerry Willis
Dee Anna Willis
Muktha Jost
Stephanie Boger-Mehall

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Preface

Our Tenth Anniversary Annual

As the Society for Information Technology and Teacher Education begins a second decade and the world faces the dreaded K2Y dilemma, I want to look back for a moment at our beginnings. There were some wonderful happenings: a serendipitous confluence of ideas with needs, of vision with determination, and of sheer happenstance

In the spring of 1990 a professor at East Carolina University, Greenville, NC, received a grant from the Board of Governors of the University of North Carolina System. They offered grants as part of the Visiting Scholars program to help teacher education programs bring nationally known experts to local campuses. Helen Harrington's grant represented the request of the Eastern North Carolina Teacher Education Consortium (ENCTEC), consisting of four area teacher education programs: Atlantic Christian College, ECU, Elizabeth City State University, and North Carolina Wesleyan University. She asked for $60,000 but received only $12,000. Dr. Harrington mentioned the problem of underfunding to another ECU professor, Jerry Willis. For a number of years Willis had been toying with the idea of a conference where researchers, practitioners, and professors interested in information technology in teacher education could meet and exchange ideas. The grant might be just enough for that and, when presented with the idea, ENCTEC agreed. The conference from then on, in Willis' and Harrington's words, ". . . had many of the earmarks of an Andy Hardy movie." As one of the early 'convert-the-barn-to-a-theater' stagehands (Note from J. Willis: Dee Anna was much more than a stage hand; she was an active participant in policy making and planning as well.) I can attest to a somewhat surreal atmosphere combined with a lot of labor that began almost immediately and resembled a three-ring-circus sort of barn production.

A call for papers was published in the *Chronicle of Higher Education.* Invitations were also sent to about 50 scholars known to be interested in the topic. We expected 15 to 25 proposals. Considering this modest estimate we joined forces with public schools in Eastern North Carolina and combined our conference with one for K-12 personnel interested in using technology. Crossover attendance was encouraged. We began to believe we could 'fill the barn' or at least not end up with an empty one. Our two rings were in place.

We knew we could 'fill the barn' when our part of the conference received over three times the number of proposals expected. A large number of the papers presented were then published in a special triple issue of *Computers in the Schools*. Excitement began to build; we worked hard to put the program together; and Michael Apple was invited to address the conference. Letters and calls flew back and forth (e-mail wasn't quite so pervasive then) explaining that it was Greenville NORTH Carolina not Greenville SOUTH Carolina. And then the Third Ring of our circus came into play.

Due to the cost of having the conference on campus we decided to go off campus to a local hotel. The conference was scheduled for May10-12th and we had booked a number of conference rooms as well as their main ballroom, which could be divided into several smaller rooms. We learned after the conference began that a senior prom was scheduled into the ballroom for one of the intervening nights. We could not simply lock up all the equipment in the ballroom. Each room's equipment had to be dismantled and ported to storage only to be reassembled the following morning. A few of us hung around that night to see gloriously dressed young people arrive giggling and trying to act mature, to act as if they already existed in an exciting future. Throughout the remainder of the conference random balloons drifted down from the ceiling and glitter appeared in strange and unusual places. What a wonderful metaphor for what was to become the Society for Information Technology and Teacher Education. Remembering that conference I feel we took some of that magic back to our classrooms and even today there are *balloons* are on the ceiling and *glitter* sticks to our monitors at strange and unexpected times.

That first conference must have been success as we were called back for an encore in Greenville. At this second conference attendees decided we should make this a yearly thing and discussion flowed around affiliating ourselves with already established groups. A number of us were tired of having the interests of technology-using teacher educators take second or third, or fourth, place behind other interests at other conferences, and we had truly reveled in having a conference just for ourselves, where we didn't have to plead for space nor see all our sections scheduled at the same time. One suggestion, that Jerry and I keep doing it all, delivered at a time when I'd been running on nervous energy for days, brought forth flames from my mouth (I hope I've been forgiven). We were already too big

for that. In the years following the first conference we did organize ourselves (I use the term *organized* in the true Willisian sense, i. e., as little organizing as possible and still function) into the Society for Technology and Teacher Education, STATE. I argued that Teacher Education should come first, but the Founder and First President, Jerry Willis, liked the acronym to spell something and we thought it catchy; we knew teacher education was first in our hearts.

By 1992 we had elected to move under the umbrella organization of the Association for the Advancement of Computing in Education (AACE) who handles the business side of the organization, the conference, the annual, and the journal. We remained STATE until a few years ago when STATE became SITTE – the Society for Information Technology and Teacher Education. It wasn't until the society truly started thinking in more international terms, and had our first Vice President for International Affairs, Brent Robinson, that we were convinced the name needed to be changed, to sound less like it was just for the 'States.' USA citizens had trouble, too, getting funding to go to STATE, because fiscal sorts thought they were going to something in their home state.

Somewhere along the line we learned that most of the rest of the world defined *technology* as what we in the US consider *industrial technology*. And what we thought of as *technology* the rest of the world called *information technology*. Our second president, Glen Bull, rejoiced in our new name, the Society for Information Technology and Teacher Education. Terrible puns on SITE and sight, inSITE and insight, bounced like silly putty balls in meetings.

Having finished the name game, thoughts turned to a constitution. The Founder's view of "Rules! We don't need no stinkin' rules!" had to give way somewhat to formalizing our collective beliefs, just in case. Sweat equity rules, i.e., s/he who sweats, rules, needed to be put in place. And somewhere it needed to be written that one continuing mission of the Society was to give aid and comfort to new members in the profession. Jerry, the other editors, and I saw a number of first papers that were truly awful, but second and third works from the same author that were wonderfully improved. Poor first presentations gave way the next year to more polished, thoughtful ones. And this didn't happen because we *didn't* accept 'iffy' proposals but because we did. And because Section Editors worked hard to get papers ready to publish and 'baby docs' saw their thoughts and theories presented in a professional manner. And they saw and experienced other professionals and were able to sit down and share ideas with them. That we the Society have grown too large to edit the papers in time for the Annual and the conference saddens me. For the first time this year, there has been no editing of the papers that were submitted. What you get is what you sent. I worry about that, in part because I have been a journal editor long enough to know that most of the papers authors consider ready for publication can be improved considerably by good editing. However, as Gary Marks has pointed out for a number of years, other conferences have used the camera ready model for years. Still, I'm sad to see that part of our support system go. But at the same time it makes me truly proud to have had a hand in this. Gone are the days when I knew almost everyone at the conference by face if not by name. This rather grandmotherly feeling is what prompted this mini-history lesson; we have so many new and eager members who just might wonder where it all began - tell them, "In Greenville, NORTH Carolina."

Yesterday, I received a conference bulletin from the International Reading Association. The theme of this year's conference is "Write the Past; Read the Future". And while I remain a Reading Person, I'm proud to say that in SITE we read the past and the present and we write the future.

Dee Anna Willis
Northwestern State University Louisiana

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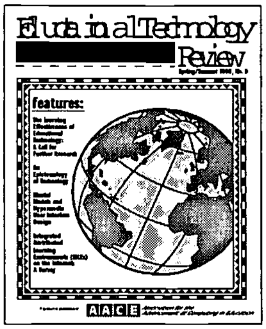
Educational Technology Review

International Forum on Educational Technology Issues & Applications

(ETR) ISSN# 1065-6901



AACE's member journal is the focal point for AACE members to exchange information between disciplines, educational levels, and information technologies. It's purpose is to stimulate the growth of ideas and practical solutions which can contribute toward the improvement of education through information technology. All AACE Professional and Student Members receive *ETR* as a benefit of membership.

WebNet Journal

Internet Technologies, Applications & Issues

ISSN# 1522-192X *Quarterly*

Focused on WWW, Internet, and Intranet-based technologies, applications, research, and issues, the *WebNet Journal* is intended to be an innovative collaboration between the top academic and corporate laboratory researchers, developers, and end-users. Columnists offer how-to articles and expert commentary on the latest developments.

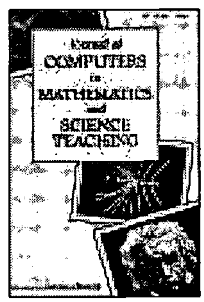
Journal of Educational Multimedia and Hypermedia

(JEMH) ISSN# 1055-8896 *Quarterly*

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

Journal of Computers in Mathematics & Science Teaching

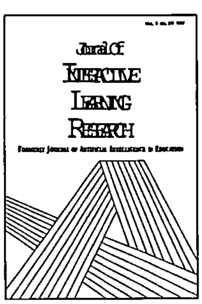
(JCMST) ISSN# 0731-9258 *Quarterly*



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

Journal of Interactive Learning Research

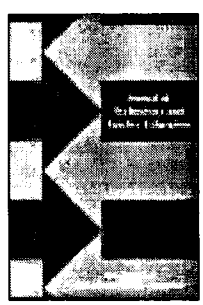
(JILR) ISSN# 1093-023X *Quarterly*



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

Journal of Technology and Teacher Education

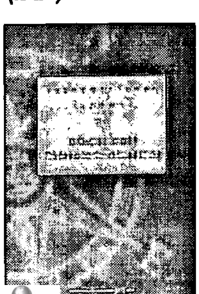
(JTATE) ISSN# 1059-7069 *Quarterly*



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

International Journal of Educational Telecommunications

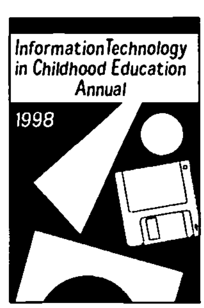
(IJET) ISSN# 1077-9124 *Quarterly*



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

Information Technology in Childhood Education Annual

(ITCE) ISSN# 1043-1055



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

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  Educational Multimedia and Hypermedia (ED-MEDIA) Division
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  Educational Telecommunications Division
- ❑ *Jrl. of Technology and Teacher Education (JTATE)*
  Society for Information Technology and Teacher Education (SITE) Division
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CONCEPTS AND PROCEDURES

K-12 Teacher Use of the WWW in Classrooms

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Abstract: 9 schools in a large suburban school district were selected to receive training on the use of information technology. Teachers were trained to use the World Wide Web, searching, and Educational Structures, a web service, in particular. These teachers were surveyed to see if they were using their new skills in their class preparation and teaching. Increased and widespread use was found. Most teachers used Educational structures as part of their preparation for classes, but not in their classes. Problems exist in the location of computers in schools and training of teachers to use the technology as part of their classes.

Introduction

The Department of Education and Human Development of the State University of New York at Brockport is in its fourth year of a Goals2000 funded project to increase teacher knowledge and use of technology in K-12 schools. The project has involved placing hardware in individual schools, training teachers to use the hardware, networking the schools, setting up a listserv for communication, and having periodic meetings and mini-conferences. SUNY Brockport has been involved in both the in-service teacher training and primarily in the pre-service training of future teachers.

Each year the number of schools involved has increased. The first year, 1995 – 1996 involved the placement of hardware and training of a core of teachers in four schools on the use of the hardware, e-mail, and listserv. The focus during the first year was for each school to develop an operational definition of professional practice school, as it would be implemented at their site. The technology was used as a support communication among schools and SUNY Brockport.

The second year of the project, 1996 – 1997, involved the addition of three more schools and a focus on multimedia applications in the classroom. Teachers in participating schools were trained in the use of HyperStudio and encouraged to use it in their classrooms and with their students. Each of the participating schools continued to use the provided technology both for communication with other members of the project as well as for the development of multimedia presentations. During this second year a core of teachers at participating schools were also introduced to the Internet, the World Wide Web, and Netscape as resources for their teaching. The focus of training on the World Wide Web was on searching and retrieving information to be used by students and teachers.

In an attempt to encourage more use of Internet resources in the K-12 classrooms, the third year of the project, 1997 – 1998, added 4 more schools, and focused on introducing teachers to a World Wide Web subscription service developed by American Cybercasting, called Educational Structures. Teachers at each of the eleven participating schools were trained on the use of this new tool and encouraged to use it in their classrooms. Pre-

service teachers at SUNY Brockport were also trained on the use of Educational Structures in their classes at the college, so that they could serve as a resource for teachers in the schools to which they were assigned.

The fourth year of the project, 1998 -- 1999, has maintained the same number of schools and continued the focus on the use of HyperStudio and Educational Structures.

The Educational Structures system is essentially a subscription service that uses the World Wide Web as both its resource and delivery system. The system is designed for both K-12 students and teachers and is organized into the subject areas of Social Studies, Science, Math, Language Arts, and Health. In addition, both students and teachers can access the Media Center for resources. Teachers also have tools available only to them through the Main Office part of Educational Structures which requires a user name and password for access. In the Main Office teachers can find lesson plans, assessment ideas, and a roster of other teachers who are using Educational Structures.

Evaluation Plan

In order to evaluate the effectiveness of training in-service and pre-service teachers in the use of Educational Structures, the authors have developed a Likert-Type questionnaire for teachers, interviewed a sample of teachers, and analyzed training records. Plans for further evaluation of the project, later this academic year, involve surveying students, with one version of the survey for elementary school students, one for secondary students, and one for teacher preparation students. A sample of students will also be interviewed, and projects developed by the teachers and students evaluated. These projects are mostly in the form of Web pages or HyperStudio presentations

Survey questionnaires focused mainly on the knowledge and use of Educational Structures and the World Wide Web in general. Data from district Technology Integration Teachers indicates what types of training were provided and the number of teachers attending. Information has also been provided by the Technology Office regarding special requests by teachers for help with projects.

In addition, the annual Mini-Conference was evaluated through the use of Likert-Type survey response forms completed by those in attendance. The overall conference was evaluated as well as individual sessions.

General Results

The following results were found after analyzing the teacher surveys, the data regarding training supplied by the Technology Integration Teachers and data from SUNY Brockport:

- A total of 256 teachers received training on Educational Structures as part of this project.
- Approximately 300 students were involved in the activities coming from this project.
- 4 Teachers have developed and implemented HyperStudio based projects in their classrooms. One high school class produced a HyperStudio presentation and a group of elementary students produced another.
- Inservice training of teachers on the use of technology, especially Internet access and HyperStudio, has rapidly migrated to the students. Students in several schools access and use information and images from the Internet in projects they do for classes.
- Teachers at one high school implemented an interdisciplinary authentic assessment program after receiving training through Goals 2000. They have reported high student achievement.

- The Goals 2000 grant has allowed the establishment of an electronic network within the school district. Schools that would not have been connected for years are already on-line because of equipment provided by the grant.

- Each school in the Goals 2000 project has developed their own model for implementing a Professional Practice School at their site. This bottom-up approach will make success more likely.

- Teachers and students have been accessing information and images from the Internet for use in lessons and class projects. Digital images have become a big part of student projects.

- Teachers are no longer "textbook bound." They are more confident in accessing current information from electronic sources such as the Internet.

- All preservice teachers learn to use e-mail and the listserv that allows them to communicate with college faculty and teachers in the schools.

- A total of 195 preservice elementary teachers received an average of 6 hours of training in the use of the World Wide Web and Educational Structures.

- Two schools in the project developed Student Teacher Manuals to be used with new student teachers.

- Student teachers at all project schools are included in all Goals 2000 activities creating more of a "community of learners."

- There has been a conscious coordination of the training of preservice teachers at SUNY Brockport with the directions taken by the Goals 2000 project. There is a real sense of cooperation and involvement of all parties. Planning and ideas from the Goals 2000 Steering Committee are used in planning preservice teacher training activities at SUNY Brockport

Teacher Use of the World Wide Web

An early analysis of the surveys returned by teachers involved with the Goals2000 project has indicated a substantially increased use of WWW resources in planning for instruction. Each of the teachers, working as part of the Goals2000 grant, has had at least one computer assigned to them. Due to location of rooms, telephone lines, network drops, and other infrastructure problems, not all of these have made it into the classrooms. In situations where the computers could not be located in the teacher's classroom, they were placed in a location within the school that would be convenient for the project teacher. Often, the telephone lines come into the main office and the teacher's room requiring computer placement at that location. As more and more schools are hooked up the wide area network in the district, more computers can be located in teacher classrooms.

The surveys have provided the following information regarding teacher use of Educational Structures and the World Wide Web in general:

- Most teachers responding to the survey used their computers between 1 and 5 hours per week with Educational Structures and the World Wide Web.

- These teachers used Educational Structures for class preparation and not for instructional or as part of work within the classroom.

- Educational Structures was viewed by teachers using it as a supplement to their usual teaching.

Part of the problem in using Educational Structures and the World Wide Web as part of the classroom activities is that in many schools teachers only have a single computer in the classroom, if any. In many cases the computer is not in the classroom at all, but in the teachers room or the school office. The logistical

considerations severely limit full exploration of the power of the WWW and Educational Structures in the classroom.

Two of the most technologically advanced schools in the Greece Central School District are K-5 schools. These schools each have 4 or 5 computers in each classroom and the teachers are experienced in integrating computer use into their teaching. This presents another problem in that Educational Structures has to date been designed with middle and high school students as their target population. American Cybercasting is presently correcting that shortcoming, but at the time the teachers were surveyed, the new materials were not available.

The middle and high schools tend to have a different philosophy and configuration. The computers in these schools are located in media centers and computer labs and not in the classrooms. Students do use the WWW and Educational Structures in their work, but not in the classroom. As computer usage expands in the district, the middle and high schools will be equipped with at least one computer in each classroom making integration into teaching easier. Until that time, both teachers and students will continue to use computers as tools outside the classroom.

Conclusions

The Goals2000 project has been successful in increasing the use of information technology both in and out of the classroom. Teachers are using the technology more than ever to prepare for their teaching. Teachers are also encouraging students to use the technology both for their own research and to prepare presentations for class to be shared with others. In a very short period of time teachers involved with the project have become very sophisticated computer users.

As a secondary outcome, teachers and technology integration teachers are looking carefully at the placement of new computer equipment in the schools. The elementary classroom configuration with 4 to 5 computers in each classroom needs to be investigated for use at the middle and high schools. The location of computer labs, no matter how numerous, inhibits spontaneous use of information technology by students and prohibits its regular use as part of the instructional process by the teacher.

A final note. Over the 4 years of Goals2000 projects the Greece Central School District and the State University of New York College at Brockport have worked closely. The result of this affiliation has been the movement of more technology training into the college classroom and more use of pre-service teachers in the public school classrooms. Working closely with the school district has dramatically changed how we train and work with pre-service teachers.

Software to Facilitate Collaborative Inquiry and On-line Communities of Learners

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Abstract: This paper will focus on using the Internet for instruction in terms of web-based software that 1) project organizers or participants can use to facilitate a richer collaboration when using the Internet for inquiry lessons, and 2) that facilitates the process of developing on-line communities of learners. Knowing the potential use and strengths of this software enhances the knowledge of techniques and tools for those who wish to facilitate, or participate in, Internet-based instruction or an Internet-based community of learners.

Introduction

More teachers are beginning to use the Internet as a tool to facilitate powerful instruction. Teachers are developing the technological and pedagogical skills for using the Internet to enhance existing activities or to accomplish tasks and activities that were once difficult or perhaps impossible to do. As the "Internet" continues to evolve, so does the ease of accomplishing successful Internet-based or assisted instruction. Four years of working with science and mathematics teachers in a large urban district, in an attempt to develop an on-line community of learners, has produced some knowledge of tools and software to facilitate this process. This paper addresses software that tends to foster greater collaboration, as well as, contribute to the development of global communities of learners. The suggestions are also congruent with what the science education community understands about exemplary science instruction and rich, collaborative inquiry in the context of the community of learners - students, teachers, scientists and others who play a role in powerful science instruction.

Expected Outcomes of Using Internet For Instruction

Exemplary Science Instruction

Science instruction, whether Internet-based or not, should provide experiences and opportunities for students to develop process-science skills and content knowledge that are forwarded in Project 2061 (1989), Benchmarks for Scientific Literacy (1993), and The National Science Standards (1996). These national efforts provide goals and indicators for those working toward exemplary science instruction. Some of the goals for students include: conveying positive attitudes about science indicating that science is meaningful and useful to them; conveying an understanding of the nature of science; identifying and solving problems effectively; working cooperatively with other students as well as independently; accessing and retrieving information, and using the existing body of scientific knowledge to investigate phenomena; and communicating ideas effectively (Berg & Clough, 1991). Many of these goals for students are facilitated when students are immersed in exemplary instruction and actively participating in science-related activities.

Within exemplary science instruction students should: 1) actively construct knowledge from what they observe and experience during the science activities; 2) ask questions, test ideas, interpret data, gather information, challenge ideas, physically and mentally manipulate objects and experiences; 3) identify problems as well as solve problems; 4) not view classroom walls as a boundary; 5) view science as having intricate connections to their daily lives; 6) develop communication skills and an understanding of the nature of science; and 7) use their scientific knowledge to generate more questions or pose and assess potential solutions to science-related problems. Using these indicators and others outlined in the National Science Standards (1996) provides criteria when choosing or developing Internet-based instruction, and knowing when the community of learners is working toward successful science instruction.

Internet-Based Collaborative Inquiry

Collaborative inquiry is defined as one classroom interacting with one or more classrooms based on a science-related investigation or topic. As outlined in Berg (1998) there is more than one right way to complete a successful collaboration. Types of inquiry include observation, sampling and analysis of wildlife, self-characteristics, environmental data, or resource awareness and consumption. In addition, collaborations may revolve around content-related, participant-dependent calculations; problem solving and engineering challenges; or debates using science knowledge. Yet, collaborations have similar general goals such as to obtain real data, draw conclusions, interact and communicate with others about the investigation, compare and contrast ideas and results and debate differences based on the merit of the data. Model or exemplary projects highlighted in Berg and Jefson (1998) provide numerous examples of how the goals and indicators listed above are intricate and necessary components of well-planned Internet-based collaborative inquiry.

Communities of Learners

This is an unprecedented time in the history of education, a time when pressures and encouragement from standards movements coincides with new technologies, tools and resources that could readily serve to support significant modifications in how students are taught science, and in what context. Never before, have science teachers, the primary architects of science instruction, had the enormous capability to readily link their students to other students, teachers, scientists, and interact based on a rich source of content and data from around the globe.

Historically, science has been thought of as what happens within the walls of the classroom. Resources for teaching are often limited to the material found between the front and back cover of a textbook. While researchers on the hunt for exemplars found situations that were quite different than the norm, the community of learners (aside from occasional guest speakers and fieldtrips) were usually limited to the students and their teacher. The "new" community of learners is now much less limited by distance, time, space as well as, the limitations of which textbook was adopted. People from many different cultures, grade levels, and experiences can come together to study science, and learn from each other. Information sources are rich and diverse, sometimes accurate and sometimes biased. The community of learners may be one partnered classroom from across the city, or numerous classrooms from across the world. It might also include a scientist from the rainforest of Costa Rica, or a scientist studying the movement of turtles in the Caribbean.

Software to Promote Collaborative Inquiry and Communities of Learners

Early experiences with the Internet required teachers to understand mainframe-based e-mail programs, and perhaps the more difficult skills such as handling attached files. Modem software, downloading files, and dealing in DOS environments provided many challenges for the novice computer user. Fortunately, the Internet environment has improved with the advent of the graphics-based web. It is more user-friendly and has lessened the importance of critical computer skills. Conversely, it has increased the number of potential teachers and students who are able to participate in Internet-based instruction.

Collaborative inquiry involves collecting and sharing data, sharing and comparing results, analyzing and formulating conclusions. An example of a simple task would be sending this information within the body of e-mail messages. Ideally, participants have the skills to exchange information in the form of text files, word-processing files, or spreadsheet files that are attached to an e-mail message. In addition, graphic images such as photos, maps or movie clips may be exchanged between participants or added to project web sites for retrieval. In some cases sound files are a useful part of the project. While much can be accomplished using e-mail and attachments exclusively, the advent of the web with graphics, sound, and web-based forms to facilitate instruction and interaction have made the process of transmitting information and interaction between classrooms much easier and less technically demanding. Many projects are now based from web home pages and contain easier methods of sharing data via forms on the web page. Participants simply need to insert data directly into the form, as opposed to sending an e-mail attachments. Worrying about the proper encoding and un-encoding formats have also been eliminated through the advent of web-based forms, as well as the automatic manner in which current web browsers handle attachments.

Software - Recent Additions and Uses

There are many potential components of a project, or the related supporting features on the project web page. Two components are highlighted in this paper and the software to facilitate these processes is identified and described. These two components are 1) organizing and facilitating student-student or teacher-teacher interactions, and 2) a project resource/related links section.

Facilitating Interactions

Collaborative inquiry might include interaction during the initial planning phase of the investigation. Usually the individual who proposes the project defines and plans the investigation, and disseminates the plans to willing partners. But, potential participants could be included in the planning phase; classrooms might submit their suggestions for how to best accomplish the task, followed by a critique of partners plans and a dialogue between classrooms as to how best accomplish the investigation. More often, collaborative inquiry usually involves collecting and sharing data, sharing and comparing results, sharing and examining other classroom's analysis and conclusions. In short, rich collaborative inquiry might involve interaction between participants in a number of ways.

As indicated previously, early methods to accomplish this task involved sending e-mail to each individual participant - the effort and workload demands increased as the number of participants increased. Consider the *Predictable Pumpkin Project* that involved over sixty participants from around the world. In some instances, establishing e-mail reflectors automated the process. After the project administrator completed a one-time entry of the participant's e-mail addresses into a list, a participant would send only one e-mail to the project's e-mail address. The e-mail would then be forwarded to all of the project participants. Current web browsers and address book functions also lessen the difficulty of ensuring that all project participants are fully informed and can interact when necessary.

But, imagine that an integral part of the project is having students read other's analysis and conclusions, and then provide a reaction or critique. Each analysis might be read and critiqued by multiple partners and the objective is to enable all project participants to have access to everyone's conclusions and the critiques that follow. The old method of asynchronously exchanging e-mail is problematic. Consider how the following software eliminates the difficulty associated with this interaction objective.

Forum Software: This web-based software is designed specifically to facilitate an asynchronous exchange of ideas. Key features include (Figure 1):

1. A participant can post their results (such as Lake Michigan Results).
2. Participants can provide their reaction - reactions are placed in chronological order of entry submission.
3. If participant X provides a reaction to participant B's posting, participant X's message is indented right below. This format makes is quite easy to visually follow the pathway of posting messages and reactions to postings. For example, Don Johnson reacted to Craig Berg, Sue Fisher reacted to Don Johnson's comments, and since Watertown High School's posting is lined up on the far left margin we know that is an original posting and not a reaction to another posting. The level of indentation makes it easy to follow the exchange of ideas.

Locating and Using Web Sites Useful for the Collaboration or Inquiry Process

A useful and sometimes critical component of Internet-assisted instruction is a list of project-related links. These other web sites might include lesson plans, content-rich sites, databases of project-related information or scientist-collected data, or any number or type of other web sites that might be major or ancillary components to the collaboration or inquiry process. The usual manner of providing a listing of useful web sites involves one person locating useful sites and then generating the list. The list may be shared in the form of e-mail, or it might be a bookmark file that would be disseminated to participants via e-mail attachments or posted as active links on the project's web page. This works well when the goal is to have one individual do all the locating and posting of sites. It becomes more difficult to compile sites and trade bookmark files as the number of participants increases, and as the number of sites located increases.

Consider the following scenario. Perhaps a community of learners - a group of 25 Biology teachers are launching an effort to work during the year to locate web sites and resources that correspond to the targeted content in Biology. Each teacher is a participant because they expect to locate sites that are useful when teaching the targeted content, and they also want to benefit from the efforts of the other Biology teachers. In short, the teachers are participating in this voluntary effort because of the potential for synergy and hope that there is a rich exchange and sharing of ideas and resources among the community of learners. Fortunately, there is software that works well when a group wants to compile web sites and provide all members with access to the useful sites.

Links Software: Links software is web-based and has the following key features (Figures 2 and 3):

1. The first task is to identify categories of targeted content and add these categories to the Links software. For Biology, categories might include things such as: Animals/Wildlife; Biology - Journals, Magazines, Newspapers; Biology Lesson Sites; Biology Professional Organizations; Environmental Science; Evolution; and Genetics/Molecular Biology.
2. After a participant locates a useful web site, they bring up the Links page and add the URL, title and description to the form.
3. Multiple participants contributing useful links results in a large number of potentially valuable resources for teaching science.
4. All participants from any computer with Internet connections can access this growing list of web sites - no trading of bookmarks. No compiling of web sites by one individual and e-mailing or working with web browser editors to add the new list to a web page.

Summary

Forum and Links software are two recent web-based additions that help to facilitate collaborative inquiry and synergy among a community of learners. As with any software, its usefulness depends on the goals and intentions of the user. For participants in collaborative inquiry who want to be involved in collecting and sharing data, sharing and comparing results, sharing and examining other classroom's analysis and conclusions, Forum software might be just the right tool to raise the interactions to a new and productive level. For a community of learners who want their efforts to locate useful web sites to benefit others, as well as benefit from other's work, Links software has the potential to make this process more seamless and less technically demanding.

- **Our Water Study Results - Lake Michigan**
  Craig Berg -- *Thursday, 10 December 1998, at 10:47 a.m.*
  - **Our Critique of Your Study**
    Don Johnson -- *Thursday, 10 December 1998, at 10:48 a.m.*
    - **Differenece of Opinion w/Regard to Critique**
      Sue Fisher's Class -- *Thursday, 10 December 1998, at 10:49 a.m.*
- **Group 25 - Data and Conclusions**
  Watertown High School -- *Thursday, 10 December 1998, at 10:51 a.m.*

Figure 1. Example of Interaction Using Forum Software

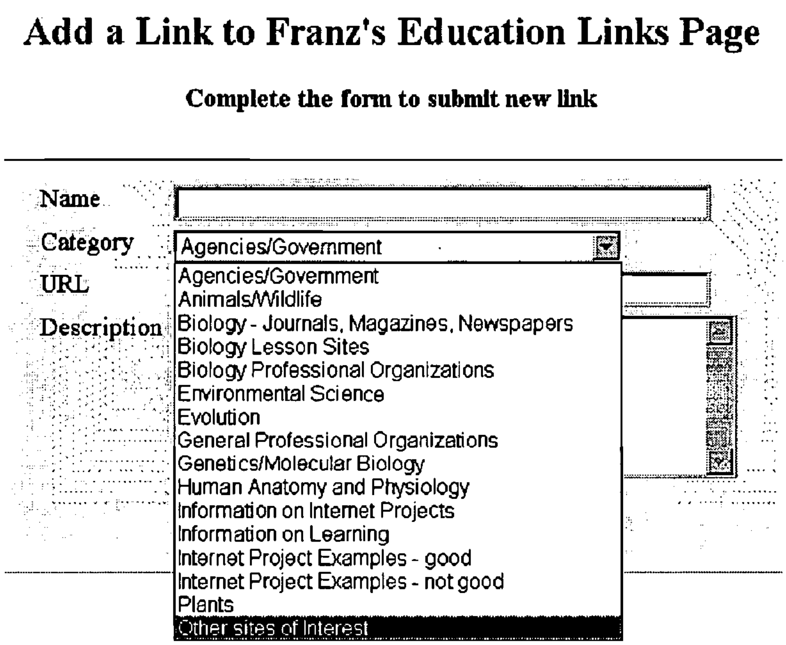

Figure 2. Pre-determined Links Categories

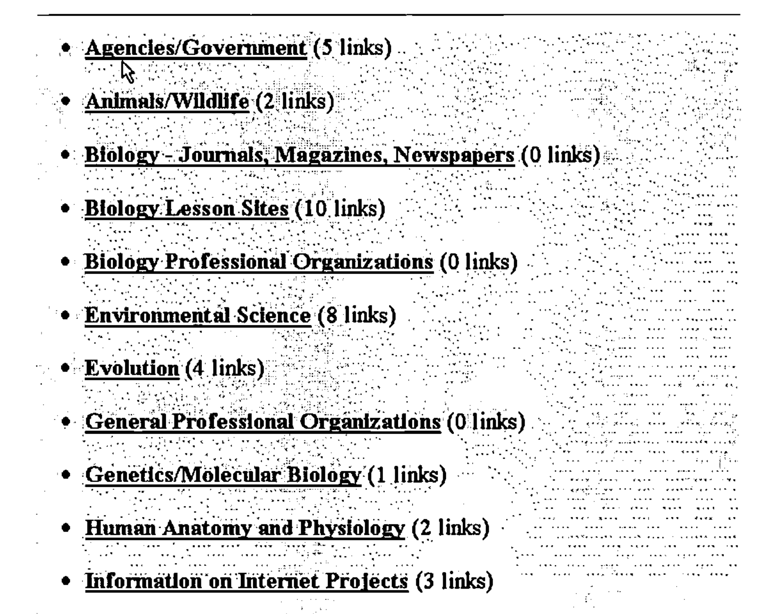

Figure 3. Categories and Number of Existing Links

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Authentic Tasks for Authentic Learning: Modes of Interactivity in Multimedia for Undergraduate Teacher Education

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Abstract: Members of the Department of Science and Mathematics Education at the University of Melbourne, Australia have developed a range of multimedia resources for undergraduate education students that allow the students to participate in authentic tasks that would otherwise be difficult or impossible to arrange for large numbers of students. The multimedia resources are designed to project students into their future role as classroom teachers as it has been observed that those students who do this tend to perform better as they can see the relevance of learning opportunities presented in their studies. Observation of student work using these resources shows deeper thinking and enhanced reflective practices in considering how children think and how classrooms can be managed.

Introduction

It has been observed that successful teacher education students are those who can project themselves into their future role as a classroom teacher – these students can see the relevance and application of material they are taught and tasks they are set from very early in their studies. For other students, it is only as they progress through their four year undergraduate degree and gain more classroom experience that the materials and tasks presented at university appear to increase in relevance to them. Staff at the Department of Science and Mathematics Education (DSME) at the University of Melbourne, Australia, have taken up this challenge by developing resources that project undergraduate students into their future role as classroom teachers by setting up authentic tasks and scenarios through multimedia resources. This paper will explore the different modes of interactivity that have been incorporated into the multimedia resources developed at the University of Melbourne for use in teacher education in the Bachelor of Education (Primary) course. [The term 'student' is used throughout this paper to mean a student in a teacher education course.]

The Bachelor of Education (Primary) degree is a four year course of study and is the principal vehicle for the training of primary (elementary/K-6) teachers at the University of Melbourne. In 1995 the degree was restructured and updated extensively. New first year subjects were first taught in 1996, new second year subjects were taught in 1997 and so forth. In 1999 the first cohort of students will complete the final year of their degree. This restructuring has been accompanied by a substantial reassessment of the direction of the course and of the priorities for competing areas. Furthermore, budget constraints have imposed a rethinking of delivery of the course and of the ways in which students undertake practical experience in schools. From the end of 1996, a reduction of 20% was made in the number of days supervised practical

work in schools ('teaching rounds'). It was therefore an ideal time to invest in revising course delivery in the Bachelor of Education (Primary) degree. Multimedia has the potential to make experience with children a well-integrated part of the university course. In the next sections we describe three recent projects and highlight the ways which we have designed for students to engage actively with the multimedia and the task.

Multimedia Resources Developed

Computers and the K-6 Classroom: Kids Can Do!

For the compulsory second year undergraduate subject 'Computers in the Primary Classroom' a resource entitled *Computers and the K-6 Classroom: Kids Can Do!* (Chambers & Dobbins 1997) was developed in 1996-97 with version 1 being launched late in 1997 (version 2 released in early 1999). This resource contains lecture notes and workshop activities, over 100 articles about using computers in K-6 classrooms, demonstration versions of software, examples of teachers' and children's classroom work with computers, and the *Virtual Classroom* resource. The *Virtual Classroom* was developed in Macromedia's *Director* program and contains QuickTime VR with embedded video clips of three classrooms, and interviews with the three classroom teachers (Fig. 1). The three classroom models illustrated are a classroom with two computers, a computer laboratory, and a 'mixed model' of classroom computers plus access to a computer laboratory. Each teacher has a different view on why their style of using computers works for them and for the children in their class. The inclusion of a range of sometimes contradictory opinions was deliberate so that our students could see that there are many ways of using computers and associated technologies effectively in classrooms. That is, the effectiveness of the use of computers was dependent not on how many computers or the layout of the computers in the room, but rather how the teacher used the resources and managed their classroom.

Figure 1: A 'flattened' image from one of the QuickTime VR photographs from the *Virtual Classrooms* from *Computers and the K-6 Classroom: Kids can Do!*

Some multimedia resources about teaching show lessons or lesson segments. One commercially available product which we have used with our students is 'Learning about Teaching' (Mousley, Sullivan & Mousley 1996). This presents video of complete lessons, which are documented and cross-referenced in many helpful ways. The *Virtual Classroom* resource is quite different, presenting instead a snapshot in time of all that is going on in a busy classroom. As our students 'move' around the room they can see what each group of children is doing and how the teacher is managing the classroom.

Teaching and Learning about Decimals

Teaching and Learning about Decimals (Stacey, Steinle, Chambers & Asp 1998) is a rich resource for practising teachers and education students alike to assist in teaching children about decimal numbers, an area of mathematics which is difficult for many children. This project is an offshoot of a major research project about the learning of decimals by children (*Improving learning outcomes in numeracy: Building rich descriptions of children's thinking into a computer-based curriculum delivery system* funded by the Australian Research Council) undertaken by Professor Kaye Stacey and Vicki Steinle of DSME and Associate Professor Liz Sonenberg of the Department of Computer Science at the University of Melbourne (Stacey & Steinle 1998).

Teaching and Learning about Decimals consists of background information, case studies of children with common misconceptions about decimals, and teaching strategies and ideas, including games that challenge children's common misconceptions about decimals. In the 'Case Studies' section, students engage in a range of modes of interactions with multimedia materials that challenge them to 'think like a teacher'. In this section there are five case studies of the most common misconceptions about decimals. For each case study there are examples of the child's work, such as a completed quiz about decimals (Fig. 2), and interviews with the child where he or she is questioned as they undertake a range of tasks that explore their understanding of decimals. The interviews are available in a static version (images with text, suitable for printing) and as QuickTime movies that have expert comments as subtitles. This range of resources within each case study gives our students practice in picking up clues about children's thinking about decimals.

Our students are challenged to deeply understand the misconceptions that children they will teach are likely to have by answering questions about decimals as if they were a child with a particular misconception. This is so that they will be able to more easily 'diagnose' misconceptions about decimal numbers and select teaching methods most appropriate to move the child past their misconception toward a greater understanding of decimal numbers.

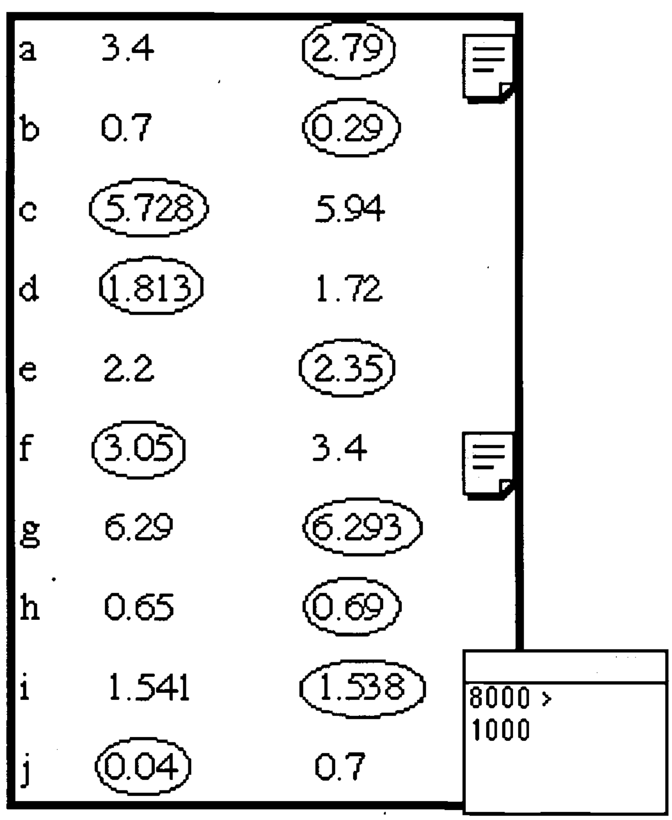

Figure 2: Choices that 'Caitlin' (a child in a case study) made on a decimal comparison test (where the child was asked to circle the larger number of each pair). The notes give a brief explanation of why a child with that misconception may have given the answer.

Teaching and Learning about Whole Numbers

This resource was developed for our first and third year undergraduate mathematics education subjects and explores operations with whole numbers including subtraction and multiplication. This resource targets specific workshops where, for example, students view video of a child doing a mathematical exercise and verbalising the steps they take (Fig. 3). The students then must categorise the method that the child has used based on mathematical principles. This challenges our students to understand the processes the child takes to do the mathematical task and deepens their understanding of the range of ways a task may be undertaken by children. Another component is based around small 'movies' which demonstrate the stages of children's learning to count.

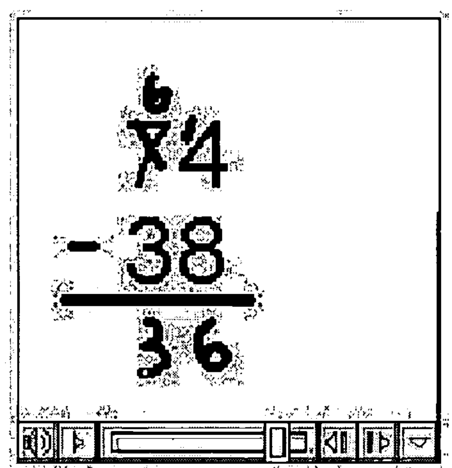

Figure 3: An example of a QuickTime movie that illustrates how one child undertakes a mathematical task with whole numbers (subtraction using the decomposition, or renaming, method).

Modes of interactivity

Analysing classroom interactions and classroom management

In the *Virtual Classroom* our students can explore the classrooms of teachers at three schools. The classrooms and teachers were selected as each is using computers effectively across the curriculum, yet there are major differences in how the computers are used and how they are set up in (and out of) the classrooms. The observation of classrooms and their workings by our students is made considerably easier through the use of multimedia as it allows all students to observe exemplary practice in the uses of computers in the classroom – something not all students have an opportunity of observing during their time in school experience ('teaching rounds') and the same experience is shared by all classmates. In addition, students can visit and revisit the *Virtual Classroom* and as their own experience grows they extract new significance from the interactions they observe.

Students investigate aspects of the room in a QuickTime VR environment and by clicking on hotspots a video clip of an interaction is played. Our second year teacher education students analysed the classrooms in the *Virtual Classroom* resource to investigate the interactions and to identify the key issues in classroom management in using computers effectively that were illustrated in the video clips. Students worked in pairs for this activity and they engaged in thoughtful discussions. Their responses indicated deep reflection on the set-up and activities in the classrooms – the level of reflection and focus on the task was greater than during other activities with these students. Below is an example of one second year undergraduate student's response to an aspect of this task. It indicates both detailed observation and identification of the key issues illustrated in one video clip.

> *The classroom was well set-up with different activity tables relating to the same theme. This scene showed how organised the boys were when they had finished their computer task. They immediately went straight to the roster chart, marked it off and checked which activity they had to move to next. It showed them working cooperatively, and they were not distracted as they knew exactly where they had to go next. The roster was placed strategically near the teacher so that she could also keep an eye on who should be where and when. All computers were placed against the back wall, with their wires placed at the back of the tables.*

Making children's thinking an object of study

Children's thinking could not be easily studied in the past because it is a complex behaviour producing minimal artefacts (usually written records) and can only be observed indirectly. One of the reasons why thinking is hard to study is that it is hard to capture. In recent years, as technology has progressed to tape recorders and video recorders, the research study of thinking has blossomed. Multimedia now has the potential to bring this into teacher education courses. This technology is enriching teacher education and is being used in the *Teaching and Learning about Decimals* and *Teaching* and *Learning about Whole Numbers* resources.

Multimedia can capture children's thinking and turn it into something that students can study. For this purpose multimedia derives its advantages from the following features:

- A vast amount of information can be stored (needed because thinking is complex behaviour).
- Examples can be stored in a catalogued form.
- Examples can be stored in an accessible form. Access for students can be vastly better than any other form of retrieval - from many places (home or university) and at any time.

By capturing episodes of thinking and enabling them to be well catalogued and easily accessed, multimedia can now provide a 'database' to be studied conveniently. Multimedia is now giving us the opportunity to create a collection of examples of thinking, which could revolutionise teacher education.

Although not a substitute for experience with children, resources such as these have distinct advantages as the scenarios presented have been distilled from research data and clearly illustrate representative case studies found in all classrooms. Our resource takes advantage of the careful analysis of selected interactions with children, to build awareness of well-documented, widespread features of children's thinking. In the classroom, teachers often have limited time to observe individual children's work and would therefore be greatly assisted if they were able to spot patterns in children's thinking. To do this, they must be very familiar with what they might expect to see. They need to gain this awareness in ways that supplement and build on their real life experiences. Mathematics education research is providing knowledge concerning things teachers can expect to see as children learn mathematics, and our resource and others such as the *Professional Development in Chance and Data* CD ('*C&D PD CD*' Watson 1996, Watson & Moritz 1997) are working to bring this knowledge to prospective and practising teachers. In this way advances made in education research are being translated into practice. The children in the case studies (child actors with scripts) are very real to our students which increases the level of engagement and

makes the tasks authentic. This projects our students into their future roles as classroom teachers with the responsibility of understanding how a child is thinking about a task. Feedback from students is very positive and assignments on this material reflects a deeper thinking than had previously been apparent.

Conclusion

The multimedia resources that have been developed for undergraduate teacher education studies at the University of Melbourne allow our students to have experiences where they can see exemplary practice in a classroom or investigate how a child is thinking about decimal or whole numbers. The development of multimedia is an expensive enterprise and we have been fortunate in receiving financial support from our University and from the Australian government for these projects. On the other hand, the choices of development modes (largely HTML and QuickTime video) and technological advances mean that keeping these multimedia resources up-to-date is now within the capabilities of our department and will require only relatively modest resources. High initial costs of time and money make it highly desirable that multimedia resources are shared amongst universities. The relatively low cost of modification, however, means that the changing needs of several different courses can be accommodated, making sharing such resources feasible.

Our experience to date has been that multimedia has enhanced our teacher education courses. It enables complex behaviours to be captured and studied 'on demand' in the lecture room - be it the complex behaviour of a class during a lesson or the complex thinking of a child puzzling over a problem. In this way, experience of the classroom can be built into every aspect of a teacher education program and shared as never before.

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The Way to Go: Integrating Instructional Technology Initiatives into a New Teacher Education Program

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Abstract: The Department of Urban Education at University of Houston Downtown first began in the fall semester of 1995. It has just started along the technology trail to learn from other institutions that have already addressed some of the issues and found some answers. This paper will survey some teacher education programs and analyze how the educational computing component was implemented. The survey finds that the teacher education programs may be placed along a continuum in their integration of technology: on one end is teaching about technology while on the other end is teaching with technology across the curriculum. It will also include personal communications from directors of some of these programs regarding their insights of the course design.

Introduction

University of Houston Downtown (UHD) is an open-admission, public urban institution in Houston. It offers 25 baccalaureate programs through 9 departments and three colleges: Business, Humanities and Social Sciences, and Sciences and Technology. The Department of Urban Education (http://www.dt.uh.edu/degree/urbaned/home1.htm) first started in the fall semester of 1995. It has responsibilities from the state as well as from the university: it has to establish a department from the policies set by Texas Education Agency and other governing institutes while living within the framework of the university.

The mission of the Department of Urban Education is to prepare future teachers for the urban classroom who will enhance the chances of academic success for at-risk children and adolescents in inner-city schools. Its teacher education program is a state approved Center for Professional Development and Technology (UHD-CPDT). The center trains new elementary, secondary and bilingual teachers, and also provides staff development and technology support for public schools.

There are approximately 150 students in total who registered for the fall semester of 1998: 16 in secondary education, 34 in bilingual education, and 97 in elementary education. The student number surges for the summer session due to the number of students who are currently teaching come back for professional development when schools are out. To help them gain the knowledge and experiences needed to be a teacher of at-risk students, the department requires undergraduate and post baccalaureate students who have been admitted to the teacher education program and do not teach on a permit in a public school classroom to successfully complete three interdisciplinary blocks in public school in the Houston area. Following the model developed by Haberman (1991), the UHD-CPDT enables projective urban teachers to participate during their junior and senior years in a 27-semester hour field-based professional development sequence in the format of blocks.

In order to provide its students with experience in using technology to enhance instruction and professional development, this young department is blueprinting its way to integrate the educational computing component into its existing interdisciplinary block structure.

Since its conception in 1995, this department has its technology component combined with its "blocks" structure. Unlike many other teacher education programs across the nation, there is not a semester-long 3-hour course dedicated for technology in classrooms. Besides, currently, there is not a full-time Instructional Technology faculty position. The students are required to take either or CIS1305 as part

of their core academic foundation from the Finance, Accounting and Computer Information Systems (FACIS) Department of College of Business and the Computer and Mathematical Sciences (CS) Department of College of Sciences and Technology. The course descriptions of CIS1301 and CS1305 are listed below:

> CIS1301: An overview of computer information systems, including computer hardware, software, procedures and systems, and human resources and their application in today's technological society.
>
> CS1305: Topics include the history and nature of computers, ethical and other societal issues, an overview of computer hardware and software (with an emphasis on computer applications and the use of standard software packages). An introduction to high-level languages with an emphasis on writing simple programs in BASIC .The use of the Internet for communication and research is introduced.

A close look at the course descriptions indicates that these two courses may fulfill the requirements as computer literacy courses, but do not offer chances for the teacher education students to exploring integrating technology across curriculum. The Urban Education Department is aware of the potential areas need to be addressed with the present course structure. But there are several existing conditions that impeding it from offering instructional technology as an independent course.

First of all, since the CS and FACIS departments have been offering those two classes for several semesters, it is difficult for the Urban Education department to change the core curriculum framework of the whole UHD and offers it within the department. At UHD, all new students are first admitted into University College. This college is responsible for the freshmen's academic progress until they officially declare a major field of study and have an official degree plan approved. Usually it is during this period that the student takes either CS1301 or CIS1305 as part of college core. Students are encouraged to officially declare a major when they have completed 30 to 60 credit hours. After declaring majors, most students of Urban Education are then reassigned from University College to College of Humanities and Social Sciences. Therefore, due to its core curriculum framework, many Urban Education majors enter the department with the computer literacy requirement already fulfilled. Secondly, currently there is not a full-time faculty position for Instructional Technology for this department. For the above reasons, it is difficult to implement instructional technology as an independent course although it seems to be the best direction.

I was hired as the Instructional Technology Specialist who coordinates the technical aspects of the teacher education program. With a doctoral degree in Instructional Technology, I came to this position in August knowing that although I am a full time staff member, I have the responsibility to teach a technology session in block I for an embedded CS1105 credit (a one-credit technology in education lab) with the following course description:

> Course Description for CS1105: An introduction to authorware systems and presentation software for the development of interactive teaching materials and classroom presentations. Examples of computer-based instruction and tutoring systems will be discussed. The use of CD-ROM multimedia teaching materials will be introduced.

The Urban Education department plans to offer a one-hour component of instructional technology each week for the block I students in order to enhance their capability of applying technology in the classroom. The students are assumed to be computer literate prior to registering in Block I.

At the current moment, we are still investigating on how to make the best use of the one-hour as well as the future directions. This young department is starting along the technology trail and need to learn from other institutions that have already addressed some of the issues and found some answers.

Seeking NCATE Accreditation

The National Council for Accreditation of Teacher Education (NCATE) is the professional accrediting organization for schools, colleges, and departments of education in the United States. The Urban Education Department of UHD is seeking NCATE accreditation, hoping the stamp of approval by NCATE will manifest to the public that the department has undergone rigorous external review by

professionals and the program meets the standards set by the teaching profession. Since NCATE's accreditation standards use candidate performance as an integral part of its accreditation system, its standards and processes would have influences on how the Urban Education Department incorporates the technology initiatives.

Following are the areas in the NCATE accreditation standards with expectations for knowledge and use of technology (Cooper & Bull, 1997):

> NCATE's accreditation standard I.C.1, Content Studies for Initial Teacher Preparation, expects candidates to "complete a sequence of courses and/or experiences to develop an understanding of the structure, skills, core concepts, ideas, values, facts, methods of inquiry, and uses of technology for the subjects they plan to teach."
>
> NCATE's accreditation standard I.D.2, Professional and Pedagogical Studies, expects that professional studies for all teacher candidates include knowledge and experiences with "educational technology, including the use of computer and related technologies in instruction, assessment and professional productivity."
>
> In NCATE's Standard III.A, Professional Education Faculty Qualifications, an indicator has been added stating that "faculty are knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship."
>
> Standard IV.B, Resources for Teaching and Scholarship, expects that "higher-education faculty and candidates have training in and access to education-related electronic information, video resources, computer hardware, software, related technologies, and other similar resources," and "media, software, and materials collections are identifiable, relevant, accessible, and systematically reviewed to make acquisition decisions."
>
> Standard IV.C, Resources for Operating the Unit, expects that equipment and budgetary resources are sufficient to fulfill the mission of the school of education and to offer quality programs. An indicator states that "facilities and equipment are functional and well maintained. They support computing, educational communications, and educational and instructional technology at least at the level of other units in the institution."
>
> (source: http://www.ncate.org/projects/tech/currtech.html)

To prepare for the year 2000, NCATE is in the process of revising its standards for implementation. Significant facets of the revisions are new standards for the infusion of technology in teacher education programs and a vision for what skills and understandings graduating students should bring into the classroom.

According to the NCATE web site as of December 1998 (Source: http://www.ncate.org/inst_rel/list/texas.html), there are 10 NCATE accredited teacher education programs in the state of Texas, including Baylor University, Sam Houston State University, Texas A&M University, Trinity University, and so on. I have looked at the homepages of these 10 programs as representative practices in technology, hoping that these models can stimulate visions of the future and give examples of effective planning processes.

Courses on educational computing in teacher education programs seem to fall into two general categories today (Jerry Willis, personal communications, July 16, 1997). One type focuses on software and hardware. Students learn to use one or more operating systems and the basic operations of several types of applications packages. This is the "basic computer literacy" approach, and the emphasis is on the skills needed to use a computer. Consequently, teachers-in-training are provided instruction in "computer literacy" and are shown examples of computer software, but they rarely are required to apply technology in their courses and are denied role models of faculty employing technology in their own work. Such courses in education are often similar to ones in community colleges and in business. They are less popular today than they were a few years ago, but they are nevertheless still common.

A second type of educational computing courses in teacher education programs, professional computer literacy, focuses on the uses of technology in the classroom. Computer literacy skills are not the

focus though students do learn some basic skills. The focus is, instead, on ways technology can be incorporated across the entire teacher education program to help students teach and learn. The student's competencies may be demonstrated through the successful completion of required projects or by manifested proficiency. The continued development of these competencies such as word processing, database management, spreadsheet, communications and graphics applications should be a part of the whole educational experience, involving the practice of technical skills in other content courses.

It is the second type of educational computing courses in teacher education programs, professional computer literacy, that is recommended for what will best fit the existing interdisciplinary block structure at UHD. The better way to maximize the outcome seems to be a dedicated Instructional Technology course offered by faculty members specialized in Instructional Technology from within the Urban Education Department.

Conclusion

According to Office of Technology Assessment, at this moment, only 18 states require training in computers or technology for all teachers seeking licensure (U. S. Congress, Office of Technology Assessment, 1995). Some states, like Texas, require a three-credit course while other states mandate that programs follow the guidelines for technology training approved by International Society for Technology in Education (ISTE) and Approved by NCATE (Texas State Board for Educator Certification, Restructuring Texas teacher Education Series 7: Technology).

In "A Message to NCATE Institutions, Board Members, Constituent Organizations and Friends", Arthur E. Wise, the president of NCATE, states:

> Teacher education institutions must prepare their students to teach in tomorrow's classrooms. Rather than wait to see what tomorrow's classrooms will be like, they must experiment with the effective application of computer technology for teaching and learning in their own campus practice. Today's teacher candidates will teach tomorrow as they are taught today.

(Source: http://www.ncate.org/projects/tech/TECH.HTM)

The general vision of the teacher education programs encourages a future-oriented stance, one in which issues of technology use are thoroughly embedded in the fabric of models for teaching, learning, and teacher education. The community consisted of the teacher education programs also promotes professional computer literacy that can be easily adopted for integration into the public school system. As the state of Texas and NCATE require more capability with technology through licensing and certification standards, schools of education will align programs to produce new teachers able to meet those requirements. Although there will be fine-tuning and corrections, this is an exciting moment for this new department at UHD to put in place a strong foundation for the years to follow.

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Helping Technology Educators to Make Informed Decision in the Textbook Selection Process

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Abstract: The aim of this paper is to provide an overview of current process in the publishing of technology-related textbooks used in K-12 schools and the possible role of technology educators in the textbook selection process. A number of key issues will be investigated: budget for textbooks, textbook selection, publishers' cooperation with the state procedure, conforming and non-conforming lists, publishers' cooperation with schools, textbook revision process, and adoption cycle. It is assumed that, by being more aware of the textbook publication process, technology educators will have a better chance of exercising their power in selecting textbooks that best suit their classrooms.

Introduction

Computers have been used in K-12 education for many years, principally for tutorial and drill and practice activities but also for innovative activities such as simulation. Computers are also widely used in education as tools. Many students, for example, regularly use word processors or drawing and painting programs. Until the 1990s, however, computer software was generally a supplement to instruction rather than a focus for primary instruction.

When computer hardware and software become the focus for primary instruction, more issues about selecting appropriate textbooks arise than ever before. For example, the operating systems, hardware support, network support, software selection, faculty training, and available software versions will vary from school to school and district to district. A textbook that does not meet the needs of a local classroom is a waste of time and money, as textbooks in part guide the teacher's instructional plans, and model the student's understanding,

Textbook Adoption in Texas

In order to provide suitable technology textbooks for use in local classrooms, all states invite classroom teachers and textbook publishers alike to be involved with the planning and revision process, although the degrees of teacher involvement vary across states. For example, Texas is one of 22 states with a process for approval or adoption of instructional materials. The Texas requires that the State Board of Education set aside sufficient money to provide free textbooks for children attending the public schools in the state. Yet each local board of trustees is responsible for determining appropriate local policy for selecting new instructional materials. Technology educators are usually instrumental in this decision-making process.

This following section includes the transcripts of two interviews: an interview with a representative from the largest technology-related textbook publisher in Texas, and an interview of a veteran teacher teaching microcomputer applications in high schools and had served on the local textbook selection committee for several terms.

A Publisher's Perspective

About Textbook Budget:

This is set by the Texas legislature. It involves millions of dollars every year with whatever subjects are up for adoption. For example, last year (1998) the budget was set at $177,000,000 for all the subjects that were to receive new books. Those subjects were: algebra, Geometry, Art, Spelling, Biology, Business Computer Applications I, II, French, and Latin. Those books will go in to the Texas classrooms fall of '98. Newly adopted books are paid for with state money, not money from local school districts.

Textbook Selection:

The state textbook committee has to approve books submitted by publishers to make sure they contain all of the TEKS ("Texas Essential Knowledge and Skills", URL: http://www.tea.state.tx.us/teks/). After their approval, the local districts can choose from the state list. Most districts have textbook committees that consist of teachers that are teaching the subjects up for adoption. Selections are usually made in local districts by February or March. Then books are delivered to the districts in the summer and ready for the students to use in the fall.

Publisher cooperation with the state procedure:

Publishers do just about anything that TEA (Texas Education Agency) asks us to do. If we do not make the state list, that means your book will have little chance of selling in the local districts.

Conforming and non-conforming lists:

Most publishers want their books on the conforming list. This means they contain all of the TEKS. Many districts will only choose off of the conforming list. However, some smaller publishers don't mind being on the non-conforming list. This just means that not all of the TEKS were in their book, but some districts might adopt the book anyway. This is usually only a few districts. If a book is non-conforming, then the teachers will have to supplement the book in order to teach all of the TEKS.

Publishers' cooperation with schools:

Publishers send review copies of their books to schools for teachers to preview. We also make school visits to talk to teachers about our books. Workshops are usually hold by publishers and teachers are invited to come hear authors, editors, and other speakers talk about their books. Publishers support teacher's professional organizations and show their books in an exhibit type setting at these meetings.

Adoption cycle:

There is something up for adoption in Texas every year. The schedule varies from state to state.

Textbook revision process:

Publishers usually revise books about every 5 years. However, that doesn't mean that Texas will adopt every time a new book is published. We sell books in every state, and each state has their own process and own schedule of adoptions. We base our revisions on teacher feedback from previous editions. We try to keep the things in the books that teachers liked and add things that teachers suggest. Of course we also have to have the TEKS if we want to be on the conforming list in Texas.

A Teacher's Perspective

The textbook selection process as you know:

I served on the local textbook committee for BCIS II (Business Computer Information Systems II) for a school district in the suburban area of Houston this year.

Your experience serving as a committee member:

I have served on the committee to adopt textbooks several times over my teaching career. It is a good experience because you receive lots of "samples" from the publishers.

How is your suggestion or recommendation accepted?

Each person on the committee has a vote – in our district we always have 4 on the committee for each topic (one from each high school). When we vote, the majority vote determines the selection. If there is a tie we discuss and re-vote.

How and where do you meet?

We met at our district's administration building for three different occasions. In our case, the district paid the committee members to come at our regular hourly rates. We stayed for half a day; each publisher has a designated amount of time to present three to four books for us to choose from. We vote to get only one for the district.

Your experience using the adopted textbooks in your classroom:

Since the committee is made up of classroom teachers, the selection is usually a good one because we know what we are looking for and what will work best in our classes.

Helping Technology Teachers to Make Informed Decision

Decision of computer-related textbook adoption at the central administration office on the state or district level is very possibly done by technology specialists and technology administrators well informed of the general technology trends. However, textbooks selected in this way may not fit the special needs of local classrooms. In order to provide suitable technology textbooks for use in local classrooms, all states invite classroom teachers, educational technology specialists, and textbook publishers alike to be involved with the planning and revision process. As the teacher has stated in the interview, textbooks recommended by committee made up of classroom teachers are more welcomed by teachers because teachers know what they are looking for and what will work best in their classes.

Textbook publishers are well aware of the importance of technology educators' input. They sometimes invite great teachers to write books for them. As the representative from the textbook publisher said in the interview, publishers send review copies of their books to schools for teachers to preview before the adoption cycles begin. Publishers also make school visits to talk to teachers about their books and get their feedback for revisions. Workshops are hold by publishers and teachers are invited to come hear authors, editors, and other speakers talk about their books. Publishers support teacher's professional organizations and show their books in an exhibit type setting at these meetings. Besides, in order to promote their textbooks, publishers sponsor workshops to provide further training for using the textbooks or the software. Teachers are also asked to sit in the selection committee to represent themselves.

Technology educators need to be reminded to practice their decision power in the textbook selection process and they also need to be informed of the available options opened to them. They can make suggestions concerning the content, format, length, and so on, because, after all, they are closest to the student, who are the real end-users of the textbooks, and on the other hands, teachers are end-users themselves. It is more likely that, by being more aware of the textbook publication process, technology educators will have a better chance of exercising their influence in selecting textbooks that best suit their classrooms.

Astronomy Connections: Linking Museums to Classrooms Through Technology

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Abstract: This paper describes an educational technology program developed by the Adler Planetarium & Astronomy Museum, entitled *Astronomy Connections*. The program partners the Adler with the Illinois State Board of Education and the Chicago Public Schools, targeting Chicago teachers and students at the K-12 levels. *Astronomy Connections* is designed to empower teachers with innovative and effective ways of integrating Internet-based technologies, museum resources, and astronomy-related themes into their instructional program. *Astronomy Connections* aims to engage students in meaningful experiences that involve collaboration and relevant applications of their learning.

Program Overview

Science and technology are powerful forces that shape human life. They have the enormous potential to make our lives better and richer, to keep our world safe and livable, and to make our society productive and progressive. Science education needs to help fulfill the potential of science and technology by ensuring the development of citizens who can think critically and strategically to solve problems in a rapidly changing environment, and who can construct knowledge taken from numerous sources and perspectives (AAAS, 1990). To meet the needs of a changing future, the nation has established a goal that all students should achieve scientific literacy.

Astronomy Connections is a three year program designed to empower teachers with innovative and effective ways of integrating Internet-based technologies, museum resources and astronomy-related themes into their instructional program to create student-centered curriculum projects. *Astronomy Connections* aims to engage students in meaningful learning experiences that involve collaboration and relevant applications of their learning. The *Astronomy Connections* model builds upon the successes of the previous projects implemented by the Adler Planetarium and Astronomy Museum. It relies on mobilizing a force of teachers who are developing more advanced skills and greater capacities at each level of participation to drive the progression of technology-based teaching and learning. It is a collaborative endeavor that will link the institutional resources of the Adler with classrooms throughout Chicago to nurture and support engaged learning and teaching strategies that prepare students for a technologically advancing society.

Target Audience

Astronomy Connections will target Chicago Public School students and teachers at the K-12 grade levels. 10 schools will be selected to participate in the first year of the program. The project staff will work with the schools to identify two classes to represent each school. These ten schools will continue throughout each year of the project, with an additional ten schools identified as new partners in years two and three.

Equitable access to information technologies in education is also becoming a central concern of educators (Panel on Educational Technology, 1997). While computers and Internet connectivity are becoming an integral part of the learning process for some students, a concerted effort must be made to provide opportunities for all students to fully utilize technology resources. In order to reach students traditionally under-represented in science and technology, criteria for participation include schools serving populations consisting of 50% or more of students from families falling below the poverty level. Additional selection factors include schools with below average science Illinois Goal Assessment Program standardized test scores and an established level of Internet connectivity.

Adler Resources

Astronomy Connections employs the latest telecommunications and science education tools to develop Internet-based scientific research activities and integrated curricula for students and teachers at the K-12 grade levels. The Adler Planetarium draws on its resources of Internet-based curriculum development experience, its broad-based astronomical and historical exhibit collections, and the educational offerings of the new Adler expansion that opened in January 1999. The Adler expansion provides participants with access to the Sky Pavilion which includes 40,000 square feet of new exhibit space, state of the art computer-driven technologies connecting students to a wealth of science and astronomy resources, the CyberSpace Technology Learning Center, and the total immersion technology of the StarRider Theater. Through *Astronomy Connections*, classrooms are linked to interactive exhibits and have access to educational opportunities unique to the new Adler Planetarium & Astronomy Museum. Teachers and students become partners with an institution with a world-renowned collection of historical astronomical instruments, a staff of research astronomers and educators, and the facilities and support necessary for a full range of educational technology applications.

Intended Outcomes

The main goal of *Astronomy Connections* is to improve the level of scientific literacy among those teachers and students participating in the program. This is accomplished by:

(improving the instructional skills of teachers through their involvement in project-based learning and the appropriate facilitation of Internet and distance learning;

(increasing the science knowledge base of teachers through ongoing staff development opportunities that provide a context in which science learning is made relevant;

(establishing opportunities for the development of a learning environment that promotes accessibility and utilization of museum resources in order to increase the level of engaged student learning; and

(providing sustained technical and instructional support for teachers.

Astronomy Connections addresses these goals through the development and implementation of program activities for both teachers and students. Throughout the academic year, teacher participants are involved in sustained professional development activities that aim to upgrade their skills and provide support for their classroom instruction by broadening their professional networks. The teachers work with their students to define the scope of the curriculum project, involving students in the research process both in and out of the classroom. The students and teachers who participate in this program become members of a learning community in which technology promotes communication and increases access to information. Interaction with museum staff and other members of this

community occurs within the museum sites, in the classroom and from remote sites via educational technology. Through these multiple modes of learning, students and teachers are provided with opportunities to expand their knowledge beyond the traditional classroom approach and to interact with educators and content experts alike. The results of the learning process are expressed by the students through web page they design, allowing the world to access their representations, their discoveries and their understanding of the world around them.

Program Elements

Astronomy Connections is composed of several elements that will enable teachers and students to approach the process in unique and effective ways.

Teacher Workshops

Participating teachers begin the program with an introductory workshop where they have the opportunity to explore the resources in the Adler Planetarium & Astronomy Museum. This workshop introduces the participants to the museum staff and focuses on a range of topics, including teaching strategies using museum exhibits, inquiry-based astronomy and science education activities, and how to facilitate learning through Internet-based distance learning experiences. The teacher teams bring their existing school curriculum frameworks to the workshop, where the Adler staff provides guidance for using the museum resources to develop their project themes and to ensure alignment with the Illinois Learning Standards and the National Science Education Standards. This workshop provides the foundation for successful participation in *Astronomy Connections* throughout the academic year.

Each month during the school year teacher participants attend staff development workshops aimed at providing consistent technical and instructional support. The model of staff development used in these inservice training sessions to aid teachers in presenting science to their students, has been shown to be effective by emphasizing the integration of activity-oriented and technology-based instruction across the school curriculum (D'Agostino, et al., 1997). Each workshop is developed to model successful science teaching methods and to teach the basics of scientific inquiry and the science process skills. Additionally, children's literature and technology resources are identified, and methods of effectively integrating them into classroom instruction are presented. Teacher participants are provided with the science materials, software, literature and teacher resources needed to successfully implement the instructional strategies in the classroom.

In order to ensure the development of skills necessary to effectively use new learning technologies, teachers attend educational technology workshops. The educational technology training workshops provide the teachers with the necessary background to use specific technologies in the classroom. The training sessions give the teachers hands-on experience in using learning technologies to communicate, navigate the World Wide Web to access information, and produce their own web sites using web development tools. As the project progresses beyond the first year, the staff will provide the equipment, training and support necessary to advance the skills of the teacher participants. The result will be the development of a corps of teachers highly skilled in the use of educational technology, and who will serve as resources and trainers for their schools.

Student/Teacher Field Experiences

During the school year, the teachers will return with their students to investigate the exhibits and collections at the Adler Planetarium & Astronomy Museum. The focus of the field trips is for the students to collect data and resource information to be included their web-based curriculum projects. The students take digital photographs of exhibit elements, go behind the scenes to investigate exhibit development and sky show production, and talk with staff astronomers, historians, scientists, artists, technology specialists, and educators to gain an understanding of various components of their curriculum projects.

School Site Visits

Throughout the school year, Adler project staff provide sustained support for teachers and students in the development of their projects. Education staff will visit classrooms to work with the teachers to plan and implement inquiry-based astronomy and science instruction and to assist in curriculum integration. The educational technology specialist and other project staff will also visit each school to offer additional training for teachers and to work directly with students on web page design. This classroom support, in addition to the field experiences and ongoing electronic communication, will result in a system for building teachers' professional capacity as well as engaging the students at all stages of the learning process.

Student Produced Web Pages

A key end product of each *Astronomy Connections* class is in the form of student produced web pages and class projects. Student activities, discoveries and ideas will be creatively displayed on the Adler's *Astronomy Connections* website. Each school's web page will serve as a progression through time and space, from one astronomy topic to another, as the students journey from Earth to the expanse of the universe. Each of these projects will be an authentic representation of the types of learning and teaching that take place throughout the program and will serve as an alternative assessment strategy for student science projects.

Teacher Mentors

In addition to continuing the technical support for the original cohort of schools beyond the first year, teachers will be selected to attend the workshop sessions as teacher mentors. The teacher mentors will work with the new teachers, drawing upon their experiences to share ideas, solve problems and brainstorm innovative ways to develop the curriculum projects. In addition to serving as mentors, the returning teachers will be provided with the opportunities to learn advanced technologies and expand their capacities. New interdisciplinary activities will be developed to pilot effective use of these applications, including the use of computer-driven video technologies to bring virtual exhibits and distance learning instruction into their classrooms.

Conclusion

Astronomy Connections is grounded in the elements of scientific literacy and the findings of research regarding the impact of technology on teaching and learning. Its basic premise is to assist teachers and students in formulating questions about the universe and to link them to resources that may provide insight into the possible solutions. The teacher participants expand their instructional approach to offer their students opportunities to gather information from museum exhibits, content experts, Internet resources, and from one another in an effort to expand their learning beyond the traditional classroom. At all stages of the program, students and teachers are exposed to the pursuit of science and will learn scientific concepts from across the domains of science within the context of astronomy. Educational technology serves as a primary tool in the learning and teaching process and provides the students with the increased capacity to communicate, research and produce representations of their understanding. Through participation in *Astronomy Connections*, teachers create learning environments that enable their students to become engaged in authentic experiences that encourage collaboration, exploration, and an appreciation for science.

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Structuring Undergraduate Instructional Technology Requirements to Meet ISTE Standards

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Abstract: the Teachers College of the University of Nebraska—Lincoln revised its pre-service instructional technology requirements to better reflect current technologies and teacher practices using this technology. The process of revision began by identifying the needs of K-12 institutions throughout the state, and was guided and informed by technology standards established by ISTE and the Nebraska Department of Education. The revised instructional technology requirements are project-based and introduce students to instructional technology theory, designing educational materials, and effective integration of technology into the curriculum. Upon graduation, each student will have a Web account with an online marketing portfolio that includes examples of instructional technology lesson plans and projects. Additionally, Teachers College will be able to verify that each of its graduates is competent in creating and using instructional technology to enhance teaching and learning.

In 1997, Teachers College at the University of Nebraska-Lincoln began revising its undergraduate technology requirements. Before the revision, students were given many opportunities to learn about and to use instructional technology during their four years in Teachers College, but these experiences varied for each student depending on his or her program. This variation, along with the demand from K-12 schools for teachers competent in the use of instructional technology, led Teachers College to structure three technology experiences for undergraduate students beginning in the freshman year. The three levels of IT experience are attached to courses required of every TC student: Education 131, CURR 259, methods courses, and student teaching experiences. Each technology experience builds upon the previous experience, and each reinforces the students' understanding of the role played by technology in the classroom. This structure ensures all students receive an equivalent and meaningful experience with instructional technology during their undergraduate studies,.

Three sources of information were used as guides in updating the undergraduate technology requirements: the Teachers College Technology Advisory Committee, and documents from both the International Society for Technology in Education (ISTE), and the Nebraska Educator Competencies in Technology Task Force.

In 1996, Teachers College formed the Technology Advisory Committee to discuss trends in instructional technology and specific ways in which the College could improve its pre-service education. Technology leaders from Nebraska K12 schools, the business community, and from the College itself were invited to participate. The Committee emphasized that new teachers need to be skilled in writing lessons that incorporate technology, as well as needing to know how to use teacher productivity tools (e.g., grade book software). The Committee also stressed the importance for new teachers to understand technology as a tool to support teaching and learning, and to avoid applications of this tool that focus on technology itself. The Committee's comments were useful in focusing attention on issues that became a framework for integrating instructional technology into the undergraduate program.

This framework did not, however, provide a means of identifying specific ways in which the technology requirements could or should be revised. Two related documents were used to supply this information: ISTE Recommended Foundations in Technology for All Teachers , and Nebraska Standards on Instructional Technology. The ISTE Foundations offer criteria for establishing teachers' technology competence (an expanded version of the Foundations have been adopted by the National Council for Accreditation of Teacher Education for use in accreditation). The Nebraska standards are based upon the ISTE criteria, offering an interpretation of them and examples of how they might be implemented in Nebraska schools. By categorizing these standards, the ISTE document provided a starting point for reviewing the variety and complexity of technology experiences offered by the College.

These standards guided and informed the revision of each level of technology requirement for undergraduates. This process allows Teachers College to certify that each graduating student has demonstrated competency in all areas identified within the ISTE and Nebraska technology standards.

Level I: Basic Productivity Tools

The Level I requirement utilizes basic productivity tools in a series of project-based activities. Level I is designed as a short, introductory activity that prepares students to use productivity tools both as undergraduates and as future educators. The requirement is attached to the freshman level course, Modern Foundations of Education, which is a problems approach to the study of selected historical and contemporary issues in analyzing the role and function of the school in American history. Students use a word processor, database, spreadsheet, the Internet, and graphic programs to research and analyze a current school issue presented as a problem they must resolve. Students create a presentation outlining their research and their recommendations, which is evaluated based on the quality and persuasiveness of research and analysis.

From these activities, students:

- understand both the work that is expected of them as undergraduates and how their undergraduate experiences relate to their future roles as educators
- produce work that has value beyond the "computer lab" by placing activities within a larger social context
- are encouraged to create a synthesis that requires questioning, problem posing, problem solving, and independent research

In the Level I requirement, emphasis is placed on the end purposes of technology tools, not on the tools themselves. The problems approach used (students must determine if an expensive reading program will be continued within their school district) encourages students to recognize ways in which technology can help them understand the complex relationship between the school organization, individual learners, and the community.

By placing activities within a purposeful context, this requirement models the process of inquiry and reflection Teachers College expects its undergraduates to embody. Students learn how to operate software and hardware, but they do so as a means to conducting the same type of research, analysis, and decision-making that will inform their undergraduate experience. In this way, students are given the opportunity to practice at an early stage the types of products and processes Teachers College expects of them.

Level II: Instructional Technology

CURR 259, Instructional Technology, is a sophomore level course required of all Teachers College students. The design of activities and projects for this course, as with Level I, were informed by the ISTE and Nebraska technology standards. The semester-long course meets twice a week in the Colleges' technology center, where each student gains hands-on experience via guided practice. One of the primary purposes for this course is to provide undergraduates the skills and the knowledge necessary to use instructional technology during their methods and student teaching classes, both as students and as future educators. CURR 259 introduces students to instructional technology theory, designing educational materials, and effective integration of technology into the curriculum. During this semester, students also register for their own Web accounts and

begin creating personal Web pages. (These pages form the basis for an online marketing portfolio, which represents the final undergraduate technology requirement.)

The following course objectives are emphasized:

1. to enhance understanding of the basic communication and productivity tools in educational technology
2. to integrate basic and advanced technology productivity tools into instruction and professional growth, and
3. to demonstrate competence in the use of computers and other technologies in research, problem solving and product development.

Students have twelve modules they must complete for the course. These modules cover a wide range of instructional technology issues and applications, but all are organized around the central theme of sharing, accessing, and analyzing information within the context of teaching and learning. Students learn about basic network and computer operation. Additionally, students continue to work with productivity tools while also learning how to design and create thematic multimedia materials. Finally, students learn how to create a Web site that incorporates text, digitized media, and multimedia products that the students have created.

Level III: Webfolios

Most of the undergraduate programs require students to develop a portfolio including examples of their work that demonstrates their growth as a student and as a future educator. During the methods and the student teaching experience, undergraduates work on their final technology requirement, creating an online marketing portfolio. This project has two purposes. First, students, when finished, have a practical tool for helping them secure a teaching position. (In fact, some graduates have reported that it was their webfolio that convinced their school district to hire them.) Moreover, the webfolio is an efficient and effective vehicle for cataloging and maintaining diverse student work over the course of a student's academic career.

For the webfolio, students include text, digitized media, and multimedia products that represent their professional interests and qualifications. Students are provided a general format for organizing their information. Each topic represents a link to more information about the student, and includes the following headings: resume, philosophy of education, instructional practice, classroom management, human relations, and professional commitment.

Problems and Results

Teachers College has implemented the revised technology requirements to varying degrees. The Level I requirement is fully implemented, Level II will complete implementation by fall 1999, and Level III is in the process of implementation. Two major factors have influenced the degree and the success of implementation.

First, the technology requirements are structures external to the undergraduate curriculum, which presents both logistical and pedagogical problems. The number of courses students must take before they seek admission to the College complicates implementation of the revised technology experiences. Teachers College uses a selective admission process that requires a minimum of 42 hours of general education course work before an application can be made. The scope and sequence of these courses is complicated, and the time to complete them is limited. Therefore, adding more courses to the curriculum as a way of integrating instructional technology into the pre-service program is not an option the College can consider. The alternative is to change the existing curriculum to offer students a meaningful instructional technology experience, but that requires that the faculty who teach these courses be technologically competent, and that they accept the value of instructional technology in education. Both faculty and academic departments have shown a reluctance to accept these changes that is based on concerns over modifying the existing content of courses while maintaining the integrity of the curriculum.

Second, faculty interest in and use of instructional technology varies significantly, as does any faculty requirement that students use instructional technology during their studies. Using technology to support faculty research is widespread, and it is common to see technology used in the classroom as an information-gathering tool. However, there is a tendency to focus on the communication and research benefits of technology, and to

consign these benefits to teachers themselves. Moreover, the relative lack of research in instructional technology makes faculty hesitant to invest time integrating technology into their teaching.

It is too early to comment on the overall success of the revisions made to the undergraduate technology requirements. Surveys of students who have completed Levels I and II indicate that they benefit from their work with instructional technology. Faculty who choose to build upon these experiences report that students have the necessary skills to do so. It will be at least two years before we can track the progress of students from the start of their Teachers College program to measure the effects of the revisions made to the undergraduate technology requirements. In the meantime, however, students now have a more structured way of gaining experience with instructional technology, and Teachers College can verify to potential employers that its graduates are competent in creating and using instructional technology to enhance teaching and learning.

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Online Collaboration: Two Models

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Abstract: This paper presents a description of two collaborative projects conducted with graduate students from two different universities, during two consecutive fall semesters. The instructors, with a history of personal collaboration both in person and online, designed an activity to provide their graduate students with the opportunity to participate in organized collaborative activities directly related to content in their courses. A year later, they again included a joint collaborative activity as part of their courses. Based on student input and instructor observation, emphasis shifted from product over process during the first year, to process over product during the second. These two models are described, including lessons learned, and a brief statement about future directions.

Introduction

Distributed learning environments are a product of the information society, as depicted in what Howard (1994) calls the "third wave school." The third wave school is described as one that provides access to geographically distributed resources (Harasim, Hiltz, Teles, & Turoff, 1995), employs instructors who serve as facilitators or guides to student learning (Doyle, 1994; Harasim et al., 1995; Keedy, 1995; Patten, 1990), and places an emphasis on problem solving and thinking skills (Batson & Bass, 1996; Boyer & Semrau, 1995). The online learning environment uniquely supports the third wave learning environment through the facilitation of collaborative learning activities. In the online collaborative environment students have access to geographically distributed resources, especially "people resources" who actually define the process, while the process structure is provided through instructor facilitation. The collaborative process itself promotes problem solving and thinking skills, thus driving the process. Recognizing the importance of participating in online collaborative activities, and of providing opportunities for students to do the same, many instructors at various levels are seeking out and joining in such activities in many formats. Online projects are numerous, and teachers can find a variety of programs that provide collaborative environments in which to interact with others.

The Setting

During the fall semesters of 1997 and 1998, graduate classes at Texas A&M University-Commerce (in East Texas), and at West Texas A&M University (in the Texas Panhandle), have participated in collaborative projects to enhance student understanding of course objectives, and to examine and/or develop procedures to facilitate the collaborative process. Students were enrolled in either ETEC 625 (Computer Research Applications), or EDT 5520 (The Internet: Organization, Design, and Resource Utilization). In both courses they studied Internet concepts, although the focus differed somewhat. Both courses, though, included units related to online ethics and web evaluation, and these have formed the basis for the collaborative projects. The first year's topic was online ethics, and the results are available online, on the Ethics Symposium (1997) pages. The second year's project had a dual focus—online collaboration and web page evaluation. During the CSC

(Collaboratively Studying Collaboration) Project, students evaluated web pages, while examining the collaborative process in which they were involved. From these two projects, two collaborative models, related partly to the approach, organization, and direction of the collaborative processes, have evolved, and these are described below, as the projects and procedures from both semesters are explained and compared.

With a ten-year history of collaboration, first as graduate students, and then as authors and presenters for publications and conferences, the two instructors were well accustomed to working together online. When they discovered that they were teaching similar courses at their respective universities, it seemed natural to extend their collaboration to include their students, providing an opportunity for their graduate students to gain experience in this arena. Issues to be considered included access, content, scheduling, grouping, and process facilitation. Ongoing collaboration between the instructors was essential, and there was often daily communication for planning, discussion, or ongoing informal-evaluation purposes. Frequent instructor negotiation occurred, as the two strove to find a middle ground that would best meet the needs of their respective students.

Year One — Product Over Process

Collaborative activities began with the instructors, with the first consideration being course content, as the instructors exchanged syllabi. In each class, a unit on ethics was scheduled after the middle of the semester, and this was chosen as the content for the collaborative effort, partly for its timing (students in each class would know each other and would be comfortable with the technology), but primarily because the topic was so important. Next, decisions about grouping the students had to be made. For the project, the area of ethics was broadly defined, and was divided into four areas—copyright, intellectual property, netiquette, and fair use. The instructors divided the students among the groups, with 12 to 15 students in each, and with representatives from each university in each group.

Because the Commerce students had more technical experiences (mist students had already taken at least two other ETEC courses), the instructors decided that the group leaders should come from the Commerce group, and the leaders were chosen based on their expertise in working with people as well as with technology. Each group also had a site coordinator from WT, and this individual was to work with the group leader as somewhat of a co-facilitator. The WT students were generally taking EDT 5520 as the first course in the master's program, and many had little if any previous experience with some of the technologies we were using.

During the first week, students exchanged messages and met for an online chat on WebBoard, the online chat and conferencing system used by the Commerce class. The WT students were somewhat hesitant at first, because the chat environment was different from the one they used, but each of the four groups met online during the first week, and in the next week's assignment message, the Commerce instructor said,

> Great job with the group meetings for the 4 different collaborative 'big groups'. I was able to attend all 4 sessions, and really appreciate the way y'all welcomed the WT folks. Interesting - if I were just 'watching and listening' and didn't know who's who, I wouldn't be able to separate the groups. :-) That speaks well of y'all, because you modeled online discussion techniques, and obviously made our guests feel right at home. :-)

The instructors continued to play a visible spectator role, and were available for consultation with groups, as needed. The focus of the collaborative activity was exploration of issues related to each group's topic, with the final product to be a set of web pages about computer-related (especially Internet-related) ethical issues. Specific guidelines were provided, to increase the probability that the pages would look like one cohesive project, although there was an attempt to allow for some individuality. The groups were to decide how to function -- with the option of breaking up into smaller groups within each topic, although all would have to work together on the final product. There was much skepticism at first, as students could not imagine how this would ever work—and amazement by some of these same students, when they were working with their groups and when they saw their final product. In a reflection, one student commented,

> I really enjoyed this assignment. I definitely was apprehensive at first, but had no difficulties once we began. I guess I just needed a little shove to get going! Thanks for the chance to get to know the ___ group!

As students looked back on their experiences, they noted aspects of the process that frustrated and that interested them. One student said,:

> The aspect of the process which was frustrating to me was trying to collaborate in a large group at the beginning..... The aspect of the process which interested me was realizing that sometimes a group is too large to be productive and warrants breaking into small groups to be more effective.... I will approach future collaborative learning opportunities by first of all making sure the group is small enough so everyone's views can be heard.

The group size issue was especially problematic when trying to get an entire group online for a WebBoard chat at one time. The java-based chat program did not seem to work well with large numbers of participants, and some home computers did not appear to work well with the interface. A few students had experiences similar to the following:

> I spent a part of the time frustrated because I couldn't seem to become involved with the discussions. One night there were technical problems and only one other person made it online, two other sessions one or two people dominated and seemed to ignore everyone else, and one night there were too many participants. I did plenty of research and was comfortable communicating the results with one or two people.

Despite any frustrations or other problems, the project was a success, and it amazed everyone concerned when it was published on the web. As one student said,

> It is hard to believe that so much was accomplished by people who were hundreds of miles apart. The final result was a concise but informative site that thoroughly covered the ethics dilemmas presented by this new technology. I am very impressed with the design as well as the content of the site. The graphics and interactivity were astounding. I think everyone should be proud.

And proud they were. This was exciting for the instructors, especially as some of the initial doubters were talking about how they would like to use similar collaborative processes with their k12 (and higher education) colleagues and students. One student wrote:

> The process of our symposium has also given me a challenge of involving teachers at my school in a similar experience in one of future staff developments and I will encourage then to try to do something similar with their students so that we can all help to promote honest people as we travel the information superhighway!

At the end of the project, the instructors took a look back at what worked and what could have been improved, in order to make the needed changes for future collaborative activities. Based on their observations, and student input, the following areas were identified for modification in future endeavors. Students felt rushed, and they suggested that it would be helpful to have more time. They also almost unanimously agreed that the groups needed to be smaller. The instructors had worked with the groups as requested, but were realizing that their involvement sometmes stifled or even interfered with the collaborative processes, as some students began to rely on coming to them, rather than on working out problems and other situations as part of the group process (thus building skills for use later, after the class was over). These concerns were recorded for consideration in future projects.

The emphasis had been on product over process -- where the main goal of the project was to research, create, and produce the Ethics Symposium web pages. How would this have worked if the emphasis had been reversed? That was the premise for the next year's project.

Year Two — Process Over Product

The following year's project, CSC (Collaboratively Studying Collaboration), grew out of a desire to help our teacher/graduate students to develop and understand the collaborative processes that they might use with other educators, as well as with their own and other students. Areas of concern from the Ethics Symposium project were also considered. In that project, there had been a feeling of being rushed from the very beginning, so the instructors decided to start earlier, and to give the students from the two universities a chance to get to

know each other. Students had complained about the large size of the groups (4 groups with 12-15 in each), so the new project had 6 groups, with 6 or 7 people in each. The instructors had been concerned that some students were circumventing the collaborative process by coming to them, and they determined to provide a collaborative group structure that would facilitate group processes. In fact, as they developed their model, they were so focused on the collaborative process, that it was a while into the planning stage before they began looking for a product on which the students could collaborate. This year, the process was definitely going to drive the product. As the syllabi were again exchanged, a common topic, web evaluation, was found, and it became the product about which the groups from the two classes would collaborate.

The week before beginning the project, to establish a common discussion ground, the graduate students at each school read and discussed 'Communication and Trust in Global Virtual Teams' (Jarvenpaa & Leidner, 1998). During the first week of the project, when the mixed groups were formed, students met in chat rooms or via e-mail to discuss concepts from the article, and how they felt these would be helpful in the collaborative process. Throughout the semester, the collaborative process driving the project was facilitated by the course instructors through the project structure. A list of individual responsibilities and roles was distributed, and each group was responsible for meeting and deciding who would do what. There was freedom to create an additional position (and define its meaning), and two of the larger groups elected to do so. Each group was independent, and all members shared responsibility for all others in the same group. The instructors watched from a distance, and had many a discussion about whether they should intercede. However, since the primary goal was to be learn to interact successfully in collaborative online groups, the importance of a 'hands off' attitude seemed essential, to promote the development of these skills. To help the groups focus without being influenced by others, each group had an assigned conference room on the Commerce WebBoard, and was able to see its own room only. Since the previous fall, WebBoard had been upgraded, and it was now on a faster server, and some of the problems were now as severe. Technical problems did still crop up. Although everyone had been required to use WebBoard chat when discussing the Jarvenpaa & Leidner (1998) article, they were told that how they met for their collaborative activities was up to them, as long as their meetings were documented.

This included specific group assignments and processes to guide the collaborative process. For any group activity, there must be a content around which the group activities will center. For the CSC project, the content was web evaluation, and each group developed its own set of criteria (based on research they conducted as part of the project), and then evaluated web pages based on that criteria. Students actually defined the process through their interactions in the development of web evaluation criteria. The process was driven by means of the problem solving and critical thinking activities that led to the development of a collaborative website, where each group had an individual page. Some students adapted quickly to the group experience, whereas others discovered that they might have to change the way they do things. One said,

> The technical aspects frustrated me and trying to get together. It showed me my writing skills need to be improved on. I also missed some of the instructions. It was there, I just didn't see it. I need more of a check list.

In answer to a question about what might be done differently before approaching other collaborative activities, this same student said,

> I will make my own check list so I will not let anyone down.

This collaborative attitude is what the instructors were looking for, and was repeated, in essence, by others. A student summed up the CSC collaborative experience:

> The project took much careful thought and planning. It was worthwhile, both in content and collaboration. Content will continue to be of use to me and the good collaborative experience will give me courage to attempt this again, knowing that this truly can work well! I am realistic enough to know that things don't always work as well, as it did with this group, but perhaps the good cooperative experience will give me an insight to help guide a group to a successful collaborative endeavor.

This is what the instructors had in mind, while evaluating the Ethics Symposium project, and while planning the CSC project. Statements like this let us know that the project was a success.

Lessons Learned

A collaborative project involves two distinct components, and the amount of emphasis given each may define the entire project. With the emphasis on product during the Ethics Symposium, the instructors were available to work with, and consult about, ongoing collaborative concerns. This however, resulted in some students not internalizing (or fully participating in) the collaborative process. On the other hand, with the emphasis on process during the CSC project, some students were disappointed in their group's final product. A group facilitator, when viewing the group's finished page, stated,

> Now that I am able to see the other groups, I'm disappointed. I feel I failed as facilitator because I did not give needed input at the end as far as the design of the page.

This person's group identification is strong -- assuming responsibility despite the fact that the group's designers were in charge of creating the web page. Interestingly, members of other groups did not agree with the page evaluation, and several rated that same page positively.

Based on student input, various components were changed after the first semester, and more will be changed based on feedback from the CSC project. These included adding time, and reducing group size. We also added more structure, but students wanted still more, so we need to revisit this and see how to get them to accept much of the responsibility. Despite the added time during the second year, we still need to find a way to get the groups together earlier for some socialization before beginning the project, according to some of the student feedback. They felt it would have been easier to begin their collaborative activities if they had already met and communicated on non-project activities. During the CSC project, the students from WT worked in groups that had already been established in their class, whereas the students in Commerce formed new groups. This mixture of groups appeared to be problematic for some, and the instructors need to address this issue before beginning the next project. Ideally, it would be more helpful if both classes had the same number of students, but that is just a pipe-dream.

The Future

Year Three is ahead of us, and is filled with questions. What will be the emphasis -- product, process, or something entirely different? What will be the structure, and how much will there be? What about the content? How will this be decided? A recurring activity and theme throughout the projects had been reflection, immediate as well as delayed. Perhaps one way to answer these questions is to pose them to the people with the most experience -- those who have participate in Year One and Year Two. Requesting that they complete a delayed reflection form, after they have had time to move on from the experience and then to look back may be a very appropriate method of obtaining input for upcoming collaborative ventures.

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Three Weeks at Camp Ed-Tech: Finding A New Model for the Educational Technology Master's Program

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Abstract: During the summer of 1998, Florida Gulf Coast University invented a new way to earn an Educational Technology Master's degree. Founded in 1997 as a university dedicated to utilizing new technologies for both local and distance learning, FGCU's School of Education has enabled learners from across the state to complete a degree program in just 13-months, in large part from their own home. Utilizing a new model combining traditional web-based distance learning with two, conference-style in-residence sessions, students gain the benefits of both distance and face-to-face teaching techniques. The two conferences are known as "Tech-In's" and last three-weeks each. This paper discusses the development of the program, the first Tech-In, and reports on the status of the students in the cohort near the conclusion of the fall 1998 semester.

Introduction

Florida Gulf Coast University is a brand new university, having opened its doors for the first classes on August 25, 1997. Many of the faculty at FGCU are new to Florida, arriving from other institutions with the intention of creating new programs for the 21st Century. As part of that Inaugural Faculty, I looked forward to being involved in the creation of an innovative program for Educational Technology - a new way to serve the dire technology needs of the public schools in our country. As the first semester progressed, a few of us "techies" began to wonder how we might integrate Distance Learning into our program, including considering putting the entire program on-line. (FGCU's administration is committed to serving 25% of its student enrollment via Distance Learning technologies.) Continued discussion lead us to believe that it would not be possible to put every course on-line, nor did we think we wanted to. But we were still faced with the desire to serve a population much wider than could easily commute to Fort Myers. The result is the "FGCU Ed-Tech Program" through which students can earn a 38-credit master's degree in just 13 months. This paper discusses the background, design, development and implementation of this program, now in its first year.

Background

Unlike most of the programs at Florida Gulf Coast University (FGCU), the School of Education (SoE) did not start from scratch on opening day in 1997. In fact, our programs were already filled nearly to capacity because the opening of FGCU meant the closing of the Fort Myers branch campus of the University of South Florida (USF). USF Fort Myers had been a significant teacher education institution in Southwest Florida for many years. Hundreds of students were in the midst of their undergraduate or graduate programs. These transition students were able to earn either USF or FGCU degrees. To earn an FGCU degree, undergraduates needed to take a few specialized FGCU courses, but graduate students just needed to make a choice. This transition period, however, meant that our curriculums could not change significantly during the first few years. And, until the *entire* faculty had arrived in Fort Myers to participate, little program development could take place anyway.

At USF Fort Myers, and now at FGCU, the "Educational Technology" degree is actually a

concentration of the Curriculum and Instruction master's program This imported degree is a 38-credit program, which includes a 17-credit Curriculum and Instruction core and 21 credits of courses in the concentration. Interestingly, of the seven concentration courses, only two are absolutely required. The other five fall into two "variable title" courses which students repeat for credit. There are both benefits and drawbacks to this arrangement. The most important benefit for us at this point in the transition process was the broad flexibility to select a set of five courses for a new program without having to seek university or state-level approval.

Design

The unique nature of being involved with a new university, and the knowledge that all of our programs will eventually be reconsidered and redesigned, allows for in interesting level of creative contemplation about the nature of our curriculum. Because of the university's focus on distance learning, our significant level of start-of-the-art technology, and the geographically dispersed nature of the students in our five county service region, the direction our program should take was fairly clear.

The first conception of the program came from Dr. Bill Engel. His idea was for a full Distance Learning program. He envisioned a program where students would take all 38 credits via distance technologies. Without changing the two required courses in our program, however, this would be difficult. Effectively teaching the required course about computer hardware and networking, we decided, would be significantly less effective in a distance learning situation. We also consider this course essential to the program, and would probably not choose to delete the course when the program is revised. This first idea was soon dismissed as unworkable so we looked for other creative solutions.

In my experience at the master's level I participated in two, two-week intensive courses. Wondering if it might work for our program, we started playing around with the idea. After a few days, I realized that if we had *two*, nine-credit intensive programs we might be able to offer our entire degree program in one year. From this we expanded the idea to include two, three-week session's in consecutive summers, along with 20 credits of distance learning courses between the two on-campus sessions. This design allows students from outlying areas to spend three-weeks "in residence" and then complete the remainder of their program at home while maintaining "normal" family and work schedules. Bill coined this potential idea a "Tech-In" and the name stuck.

Development and Implementation

Two barriers stood in the way of initial success: fully conceptualizing the idea and actually creating and pulling-off a Tech-In. Surprisingly, there was little or no administrative resistance. As we talked about our program idea around campus, it soon turned into a "high-profile" undertaking with both encouragement and financial support from the highest levels of the university. The unique fit into the administration's conception of "distance learning" and the potential to increase our distance enrollment clearly earned that support! Of course, when real money followed words of support, we were then able to begin putting the program together.

Early in the spring semester of 1998 we had a working plan: two summer Tech-In's of 9 credits each, separated by a year of distance learning, web-based courses for 20 credits, totaling the program's 38 credit requirement. A variety of issues needed to be worked out quickly, i.e., Which courses would be taught at the Tech-In's and which via the Web? In what order would the courses be presented? Do we operate it as a cohort program, with only one, yearly entry point? What about students already in our program? The summer Tech-In's presented additional issues. During the first summer we did not have residence halls available on campus, so one of the biggest problems was housing. Other issues were food (the dining hall closed at 4pm every day), a daily schedule, what to do about the July Fourth holiday, and getting a computer lab dedicated to our classes for a three-week span. Working through these issues put us further and further into the spring semester so we became unable to admit new students to the degree program in time to attend the Tech-In. This forced us to allow students to attend as non-degree seeking students until their applications were fully processed.

The curriculum in place for our degree program consists of five "Foundation" courses and seven

"Technology" courses. Discussing with the faculty for the foundation courses, we picked the two courses likely to be the most difficult to transfer to a distance learning, web-based format. Each of these two courses was assigned to a Tech-In, and the remaining three were slated for distance delivery in fall, spring, and early summer. The technology curriculum has two required courses, Instructional Design and Hardware Systems, and five "elective" courses. These elective courses must be chosen from two, variable-title, course numbers (EME 6936 and EME 6930). This powerful flexibility allowed us to create courses that could compliment and build on one-another as students progressed thought the program. Two variable-title courses were assigned to the first Tech-In, and a variable-title programming course, along with the required Hardware course were assigned to the second Tech-In. The remaining courses were spread throughout the year (Table 1).

1998 - 1999 Course Schedule		
Semester	**Course**	**Course Title**
Tech-In '98	EME 6936	Building and Managing a Web Server
On Campus	EME 6936	Multimedia Tools for the Web
	EDF 6432	Foundations of Measurement
Jul/Aug 98 *Web*	EME 6936	Enhancing Instruction: Mindtools for Critical Thinking
Fall 98	EDF 6284	Problems in Instructional Design for Microcomputers
Web	EDF 6215	Learning Principles Applied to Instruction
Spring 99 *Web*	EME 6936/ EME 6930	Elective or Independent Study
	EDF 6481	Foundations of Educational Research
May/Jun 99 *Web*	EDG 6627	Foundations of Curriculum and Instruction
Tech-In '99	CGS 6210	Microcomputer Hardware Systems for Education
On Campus	EME 6930	Programming for the Web
	EDF 6606	Socio-Economic Foundations of American Education

Table 1: Original 1998-1999 Ed-Tech program schedule.

Once we had decided on the curriculum, the political decisions followed close behind. With a great amount of discussion, we decided that to participate in any of the distance-learning courses, students would need to attend the first Tech-In. We reasoned that the Tech-In would unify the students into a cohort and would allow them to continue to work very closely, even over the web. "New" students would not be known by the group and would work against the atmosphere we hoped to create. It was also decided that students already in our program would be allowed to attend the Tech-In's, and join the cohort, only if they needed all three courses, or could substitute the Independent Study for one of the classes.

One of the most important parts of the plan was to create an "executive degree program" atmosphere for the students. As a brand new university, there was still a lot of disorganization. Worse yet, there were no residence halls or conference services to assist the development of the program. Any atmosphere and structure we hoped to create, we needed to create on our own. Creating the "executive" atmosphere began with our advertising and application procedure. A web site was created in early January to fully describe the program and the procedure for applying. An on-line application was programmed and was made available in early April. Surprisingly little direct advertising was necessary, and, by the week prior to the Tech-In, the program was one seat from being full. Unfortunately, because we had not been able to complete the entire admission process for the students prior to the Tech-In, we had a significant number of no-shows. Still, on June 21, 1998, 22 students arrived on the now one-year old FGCU campus for the first three-week Tech-In.

The Tech-In

We believe that the most unique and innovative aspect of our program is the Tech-In. Students begin and end their Ed-Tech master's degree program with Tech-In's, the only "in-residence" portions of their year. Clearly, a lot rides on the experiences of each three-week session.

The first Tech-In (summer 1998) consisted of three, three-credit courses spread over three-weeks. Arriving on Sunday night for an orientation, students picked their workstations and got to know one another, ready for a flying start at 8:30 the next morning. For 14 days (not including weekends and an extra day off for the July 4th holiday) students worked diligently from 8:30 am to 10:00 pm on their three rigorous courses. As planned, two of the courses were technology concentration courses, focusing on the World Wide Web, and designed specifically to compliment each other. The third course was a foundations course. Students were provided with one-hour per class work time as well as time for lunch and for dinner. The remaining time was spent in session.

All sessions were held in the same 30-seat computer lab. Since so much time was spent in this room, the students essentially "moved in" and fondly dubbed it "The Dungeon." One student even donated the use of a small refrigerator, which conveniently stored the snack food and caffinated soda it took to get through the long hours.

During the first two days, students installed and began managing an NT Server computer in a domain atmosphere, installed and began setting up Microsoft's Internet Information Server 4.0 (IIS 4.0), and installed and utilized a multitude of application software. With a lab full of servers, students were able to develop their understanding of server management rather quickly. Once their servers were stable, the students developed multi-media based web sites and learned to manage the variety of chores that accompany web site construction and hosting.

During the second Tech-In students will put together new computers from parts, and then re-install NT Server, IIS 4.0, and the applications. From there they will study hardware and network issues in great depth and construct interactive web sites using ASP technology.

The first Tech-In was an academic experience unlike any that I have been involved with. It would be nice to say that the powerful, cooperative atmosphere that developed was exactly what we had planned. But honesty must note that it was much better than we had even hoped for. Managed from the start as a complete "conference" rather than just three classes strung together, we worked very hard to create a productive environment. Interpersonal dynamics can never be counted on, so we were fortunate to have 22 students who formed a very tight-nit, supportive group. And we facilitated the experience with the psychology of group-dynamics very much in mind.

The success and power of the Tech-In is reflected in the following comments from students:

> I am so glad I had this experience. This tech-in will probably be one of the most important professional events of my life. It has opened my mind up to so many opportunities and possibilities.
>
> Developing and learning together, the 22 (plus the 3 of you) of us became a village, a community with shared interests. I feel privileged to have been a part of this.
>
> It was exciting, frustrating, exhausting, and I'd do it again in a heartbeat..... after I recover from the sleep deprivation.

The Rest of the Year

Leaving the Tech-In on a Friday evening, most of the students were back in class by Wednesday. Only this time it was the virtual classroom of the World Wide Web. With 20 credits to complete in just 11 months, it was important to get right back to business. The first distance learning course was scheduled from mid-July through the end of August, and presented the *Mindtool's* philosophy of utilizing computers in the classroom (Jonassen 1996). Managed as a seminar, students read the text and then discussed it with classmates on a discussion list. The class was facilitated with *Web Course in a Box* and supplemented with audio "lectures" utilizing streaming media.

Beginning nearly as well as the Tech-In had ended, this first distance learning course continued the powerful learning environment that had developed over the previous three weeks. Taking a cohort of

students who know each other so well into a distance learning course was a wonderful experience. Having no need to "test the waters" and learn about one another, the virtual discussion's got off to a fast start. Unfortunately, the class also introduced the first significant problems for our cohort. Returning to the many responsibilities each student faced at home, some students were unable to participate to the level required in a six-week course. In addition, the first significant planning error surfaced. As students were completing the first course, and preparing to begin the two fall courses, most of them were also trying to begin a new school year as teachers. The frustration of the students, along with the difficulty of the two fall courses caused a few students to drop one or the other fall course. But with flexibility, we were able to relieve some of the pressure on the students, and, as of this writing, most students completed the fall semester courses successfully.

New plans for the next cohort of students during the 1999-2000 academic year have been proposed based on the feedback of students. The most significant change in the schedule is the overlapping of courses, and the more even distribution over the courses over the year. We realized that when running a cohort program, there was little need to remain constrained by the traditional university schedule. Next year, only one course will be commencing at the same time as the fall semester in public schools is beginning. And one course will span the fall and spring semesters, running from October through February (Figure 1). We hope that these changes allow students to focus on their coursework more completely.

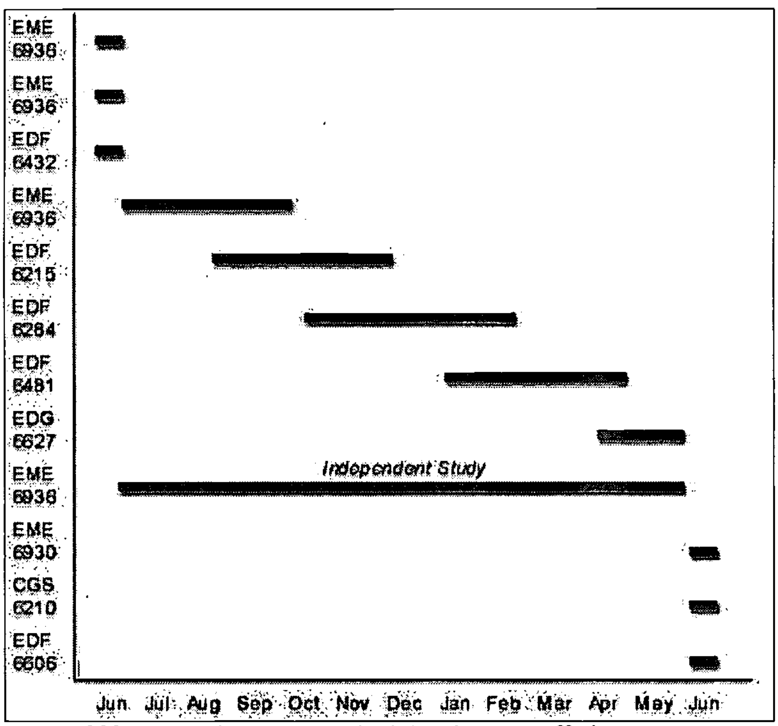

Figure 1: 1999-2000 EdTech2000 schedule of course offerings.

Conclusion

The Educational Technology program at Florida Gulf Coast University was fortunate to begin with curriculum that allowed considerable flexibility and an administration that fostered innovation in program development. Many of the faculty at FGCU chose to move to this institution to be part of creating something new and interesting. We believe that the 13-month Ed-Tech program is a good example of this type of unique innovation.

Though still running its course for the first year, feedback from the students continues to be very positive. Attrition is becoming a potential problem, but is avoidable in the future with a change in scheduling philosophy for upcoming years. By the date this paper is presented at the SITE '99 conference, we will be well past the half-way mark and will have much more information to share.

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Technology Diffusion and Innovations in Music Education in a Notebook Computer Environment

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Abstract: Valley City State University was the second university in the nation to adopt a notebook computer environment, supplying every faculty, staff, administrator, and student with a laptop computer and 24-hour access to the World Wide Web. This paper outlines the innovations made in the music department to accommodate the infusion of technology over a period of several years. The first section describes the university decisions, grants received, and implications of both in terms of faculty training and the integration of technology into the curriculum. The second section outlines the CD ROM electronic portfolio Title III grant and its effect on student assessment in the classrooms across campus. The music department developed several projects utilizing technology and the CD ROM assessment project to participate in the innovations campus-wide. The final section describes future needs and concerns.

Introduction

Valley City State University in Valley City, North Dakota is on the fast track to the future. In the words of its President, Dr. Ellen Chaffee, in her State of the University Address in August of 1995, it's "a bullet train" to the 21st century. In actuality, the process had begun approximately five years earlier, when in 1990, VCSU began moving in a new direction. Like turning the Titanic, turning a university system needed to be well in advance and wide enough to make a difference in heading, if even slightly, to set a new course. Those early decisions led to the university receiving a $1.4 million dollar federal grant, facilitating a total notebook computer environment at VCSU, the second in the nation to do so. (University of Minnesota Crookston, was the first. Also, Waldorf College in Iowa implemented the same initiative in the same year as VCSU.) The new bearing continued to support and promote the training of pre-service teachers, business graduates, and pre-professional students while at the same time weaving educational technology into the everyday lives of the university community. Several significant contributions to the state and national educational technology arena were made by VCSU in the past eight years. They are: (1) the success of the Center for Innovation in Instruction, a K-12 computer training facility located on the campus; (2) the acquisition of several large grants; (3) the successful integration of the notebook computer initiative; and (4) national recognition in such magazines and journals as the August 1998 issue of *U.S. News and World Report* as being one of the top regional liberal arts colleges in the Midwest.

Valley City State University offers four bachelor's degrees with more than 75 courses of study, over 1,100 students and 125 faculty and staff. VCSU has moved from traditional campus-based instruction to meeting the changing educational and training needs of the state's citizens through technology-intensive learning with notebook computers, multimedia, and CD ROMs; competencies, individual responsibility for learning, and documenting results for learning and teaching strategies; and new relationships with communities, employers, and society.

"You never change anything by fighting it. You change things by making them obsolete."
-Buckminster Fuller

Purpose of the Paper

This paper will address the notebook initiative's roots, diffusion, and eventual adoption and innovations as experienced by the music department faculty. Valley City State University is a member of the National Association of Schools of Music with a small faculty of 4 full-time members and five adjuncts. The age of the current faculty averages about 37 years, with each member having varying degrees of computer experience and levels of comfort. As research suggests, these may be factors in the adoption and integration of computers into a culture or society. Additional factors are time spent with the technology and level of involvement in the decision to adopt technologies. The level of integration into the music curriculum has been on an individual basis; however, the faculty is currently completing the final stage of planning for technology integration throughout the program. In a recent study provided by a staff member at VCSU for her doctoral dissertation, VCSU was compared to two other universities in the state with various time lines and methods of adoption of notebook initiatives. Corwin (1998) found that VCSU faculty were more involved with the initial decision, had a greater sense of responsibility to one another, administration, and students, which could be construed as a sort of "peer pressure," and had a strong organizational culture of innovation. The National Council for Accreditation of Teacher Education (NCATE) team that visited the university in 1996 wrote:

> Valley City State University through its collaborative work with the Center for Innovation in Instruction (C.I.I.) ... and through the initiative of its faculty in pursuing grants, has achieved a synergy of vision and mission in action which would not normally be possible for an institution of its size and financial resources. In this case, the whole is greater than the sum of its parts. Noting that institutional culture is notoriously resistant to change, VCSU has achieved virtual transformation of the culture of the entire institution...these multiple efforts have worked in concert, focusing philosophy, and broad range of human and financial resources, to create institution-wide movement toward their long range vision to be a leader in technology in education.

A Brief History of Technology Diffusion and Adoption

Recent studies on campus indicate that sixty-three percent of the faculty have integrated computer use in their teaching in some form (Holleque, 1996, 1997). Current course syllabi reflect these changes and innovations throughout the campus. As the history of this initiative will show, this was not always the case. A needs assessment was conducted early in 1990 with the new State Board of Higher Education mission of technology leadership as the driving force. Rather dismal results showed that (1) students, faculty, and staff needed more and upgraded hardware and software, (2) technical support and training had low ratings, and (3) funding was available for upgrades every 10 years if labs and desktop computers remained the mainstay. Work toward the new mission of technology leadership began with a grant for an assessment study that led to the eventual decision to use electronic portfolios and outcome-based abilities as the new technology-driven method of assessment. By 1992 all faculty had desktop computers on their desks and a Bush grant was in place for faculty development and training toward that end. The next big step would be to write grants which would provide additional monies to carry out the CD ROM portfolio plan.

Meanwhile, in the spring of 1995, the technology planning committee boldly chose to adopt the notebook environment with the approval of the faculty, staff, administration and student body. Thus, the initiative for a notebook environment began. Remarkably, VCSU received no additional state funds to make the transition to notebook computers. Expenses for the transition were covered by reallocation measures. For example, the university survived on a $10,000 budget for all equipment needs for two years. By February of 1996, all full time faculty had IBM Thinkpad computers loaded with Windows 95, Microsoft Office, Novell Groupwise, Anti-Virus software, and Netscape. Students were dispensed the computers in the fall of 1996, along with a technology fee of about $900 per year. Each multimedia classroom was equipped with a projection TV, scan converter, VCR, O.H. camera, and printer. Some rooms also contained stereo systems and videodisk players. Other classroom renovations included new desks, chairs, electrical outlets, and access

to the computer network. Some chalkboards were replaced with white boards as well (Corwin & Hagen, 1997).

All administrative and faculty offices, nearly 30 classrooms, the library, and the dorms have direct Internet and LAN access. Universal accessibility has meant a reordering of nearly every course on campus in terms of curricular updates, as well as a restructuring of the assessments that have been a part of traditional learning environments. A portfolio assessment plan was adopted as a tool in the general education courses and major studies that will *require* students to create CD-ROM portfolios prior to graduation beginning with the present 1998-2000 bulletin.

The Portfolio Assessment Project

The CD ROM portfolio assessment project was funded for a five-year period in October of 1995 by a Title III federal grant under the Department of Education. This $1.7 million dollar grant was awarded to VCSU and its partner school, Mayville State University, which shares several administrative services including the President, Dr. Ellen Chaffee. The grant provided for a five-station multimedia lab to train the students and faculty on the hardware and software and to create the CD-ROMs. A full time director of the grant program was hired to lead the training efforts. One of the most important success factors was the new Help Desk with a director plus twelve students offering online, telephone, and onsite help options. The Help Desk also serves as the total service center for the notebooks including preparation, distribution, inventory, repairs, and loans. Faculty and staff training was accomplished in part with the addition of university courses available for credit. Finally, another Bush faculty development grant worth approximately sixty thousand dollars per year over three years was received. This grant allowed for individual projects as well as departmental or institutional projects, travel to conferences, bringing in consultants, and onsite special training groups to be funded.

The initiative moved forward again in the fall of 1998 to include similar workstations being placed in each division so that students had better access to the equipment as well as providing the opportunity for divisions to add subject-specific software to enhance their portfolio projects. Students and faculty alike have access to the local area network and internet from these sites as well as from the notebooks, offering options for sharing the multimedia projects and for accessing information while preparing them. (The music school workstation has yet to be networked, but is scheduled for early 1999.)

A steady increase in the usage of various software, different computer technologies, and required student use within the courses has occurred. A mentoring approach was used to accomplish that task, beginning with learning teams of representatives from each division being initially trained. Title III monies were available for this team during their own training and for their time in training others. This approach worked very well to disseminate the information and training among faculty. Various monetary and equipment incentives were used along the way via the grants to keep the momentum moving forward. A serendipitous result of the mentoring approach was to create an environment of concern and the nurturing of others in the university community, which helped to propel the momentum. A real sense of teamwork and cooperation was obvious and proved to be a significant factor in the adoption of technology usage.

The full time music faculty have all been mentored and have implemented at least one technology project per course toward student-produced electronic portfolios. Currently the department is working to map these projects across the major and minor degree programs for effectiveness in delivery and thorough coverage of the assessment goals. Following is a description of some of the projects and how they are embedded in the CD ROM assessment tools developed by the university.

Electronic Portfolio Assessments and Technology in Music Projects

The purpose of the first project was to integrate a music theory portfolio project into the university-wide decision to implement assessment portfolios which reflect the results of research done by the Secretary's Commission on Achieving Necessary Skills (SCANS) in 1990. This commission's research produced two major publications: *What Work Requires of Schools* (1991) and *Learning a Living: A Blueprint for High Performance* (1992). These publications define skills critical for success in school and in the workplace. These documents formed the basis of the VCSU Abilities.

Five abilities were chosen for inclusion in the portfolios. Each ability has several SCANS skills contained within it. Following is a list of the abilities with example SCANS skills within each. They are: (1) Communication/Aesthetic Responsiveness (writing, math, speaking, listening); (2) Problem Solving (creative thinking, reasoning, decision-making); (3) Effective Citizenship/Global Perspective (teaching others, exhibiting leadership, working with diversity); (4) Collaboration/Wellness (responsibility, sociability, self-management); and (5) Technology (selects and applies technology, acquires and organizes information). Students must demonstrate their skills within these areas through projects, which individual faculty devise and require as an integral part of their coursework.

The Music Theory Composition Project

All freshmen majoring in music must take beginning music theory; therefore, this course was chosen for a pilot project focusing on the Problem-solving Ability and the SCANS skill of Decision-making (Hagen, 1997).

First, students were divided into groups of three or four to work cooperatively and provide evaluations. Then, the problem was given in increments based upon the concepts covered in class. The first assignment was to compose a melody of 16 measures that had the characteristics of a "good" melody as discussed in class. The students were then asked to write about how their melody evolved—how they made their choice of where to place the climax, for instance. Their criteria of a good melody served as the basis of their melody evaluations by both themselves and their peer group. Next, they were asked to add sequences and extensions according to the "rules" which they defined through reading in the text and through class discussions. The assessment procedure was consistent throughout the course of the project. Each student, then, composed a melody from which every other assignment was built. Students were able to see how their initial ideas were changed and developed as they learned more about melodic structure.

The next step was to rewrite the melody according to 16th century models. This meant a complete revision for many students in order to match the "rules" of that time period for horizontal intervallic structure, melodic direction, etc. Next, they were to add a counterpoint to their melody, being cognizant of the vertical intervallic structure and cadences. Following each revision procedure, the students were asked to write a reflective statement describing any difficulties they encountered, what they needed to change and why, and their impressions of the new arrangement.

After an introduction to figured bass, the students were to construct the inner voicings of their two-voice piece in Bach chorale-style in first species counterpoint. Next, cadences were changed to match the style and the students were invited to add nonharmonic tones to the melody. The students continued to modify their pieces as they learned about seventh chords, phrasing, and periodic structure. The final compositions also included a secondary dominant, a modulation, and a return to the original key. Some handwritten work was scanned as part of the generative process of the project, an essential part of the portfolio assessment.

The pilot project was completed mainly by handwritten exercises. However, some of the work was completed in the Macintosh lab using *Overture*. The current project is constructed in *Music Time*, a program located in an IBM lab in the music school (The notebook computers were used for all other aspects of the project, including e-mail usage among students and the instructor). A graphic was created from the notation and placed in an html document with a link to its matching MIDI file. The student and peer evaluations were not kept as a part of the portfolio; however, the composer's reflective statements were included. If decisions were based upon the evaluations, the reflective statement included that reference. These statements helped to define the level of performance at which the student was operating while making the changes in the pieces.

Each SCANS skill has five levels within it for assessing degrees of proficiency. In Decision-making, level one is "understands decision-making process and recalls basic rules/principles allowing for the identification of goals and constraints." For instance, if the students completely rewrote the assignment several times, that might suggest that they were operating at a level three by analyzing the situation and the information, considering the implications, and compiling multiple viewpoints. If the students were able to define changes *only where they were needed* on the initial rewrite, they were more likely to demonstrate a level four performance. Level four indicators are demonstrated by generating and evaluating alternative solutions and formulating a plan of action as the result of the prediction of the results based upon prior knowledge or experience. Several students were able to reach level four, but only two were considered to have met level five in which they could judge consistency and precedence of their decision or clearly

compare their work to exemplary models. Most students were able to create a satisfactory composition to match the assignment; however, many were unable to clearly verbalize about their work in a consistent manner. Not surprisingly, the two who were able to best verbalize their thinking processes were also older than average students. An example project is located at:
http://www.vcsu.nodak.edu/offices/FineArts/faculty/Sara_Hagen/Jill/index.htm.

Music History Projects

The music history project was designed as a semester-long cumulative inquiry on a single topic, with each student in the class having a separate topic to research and then present as a final speech. The ability was Communication/Aesthetic Responsiveness with the SCANS skill of speaking. Students prepared a Power Point slideshow to accompany their speeches. An example of a topic: the approach to tonality is constantly changing. What are some of the different views on tonality that we have studied? What is considered consonant, and what is considered dissonant? During different periods that we studied this semester, how much dissonance or chromaticism was acceptable? Which composers were drawn to dissonance? Which composers strove for a more consonant sound?

Piano Classes and Applied Lessons Projects

The theme that generally threaded throughout these areas was the ability of Collaboration and Wellness. Various projects focused on the SCANS skills within this ability such as responsibility, sociability, participates as a team member, and self-management. The traditional assessment tools of performance were intertwined to include the SCANS skills. The performances were videotaped and recorded. The students then were able to take these raw materials to the workstation to use Adobe Premier to mesh video clips with audio, including transitions and voice-overs, and later burn into their CD ROMs. Conducting classes and student teaching videos are handled in much the same way.

Music Methods Projects

Two projects were considered to be especially important by the students themselves in the fall 1998 semester. Both had been implemented the spring 98 semester in Music for Elementary Students for nonmajors. The fall 98 class was a combination of music minors and nonmajors. The first project was also shared in the Music in the Junior and Senior High School music majors as well.

The first project was a presentation using Power Point on the topic, "Teaching with the National Standards." This project was designed to meet the ability of Effective Citizenship/Global Perspective and the SCANS skill of teaching others. The students were to research the standards in addition to their learning from class discussion and readings to determine how the standards would personally affect them and their teaching practices. Other arts education classes were invited to the presentations and they were videotaped to air on the local VCSU TV network newscast. The presentations were compiled into html documents and placed on the class syllabus website. An example of one of the papers is located at:
http://www.vcsu.nodak.edu/offices/FineArts/faculty/Sara_Hagen/standards.html.

A second project in the methods courses for elementary teachers involved research of three musical cultures, each using a different source of information. They were to use the internet, the university library, and an interview with a person from a different heritage from the predominantly Scandinavian or western European background of 98% of the student body. This project met the ability of Effective Citizenship/Global Perspective and the SCANS skill of working with diversity. Students found a variety of sources, but confirmed that they learned the most from the live interview. One of the interviewees actually came to class and taught an ethnic dance from Bulgaria. The presentations were made with a Power Point slide show accompanying them and given to the class. An example of one of the presentations is located at
http://www.vcsu.nodak.edu/offices/FineArts/faculty/Sara_Hagen/Kristi/multi.ppt

Future Plans for Projects

The current project of mapping all of these individually crafted projects into a unified whole as a department, then as a division, is an important component of the assessment program. Each division and department was charged to do so. When compiled, the divisions will revisit their choices of projects and work to balance the abilities and SCANS skills with a spiral approach to the levels of achievement to help students produce a meaningful assessment upon graduation.

The culture at VCSU is constantly changing and growing. The music faculty have many ideas that are in planning stages at the present time. The faculty is constantly looking for ways to integrate the technology with the assessment tools and course content. Our present needs assessment indicates that digital audio equipment and recording facilities as well as an acoustically-sound environment for performance is essential. In order to produce high-quality CDs, these requirements must be addressed. Each year, the technology committee meets to determine the needs across campus and prioritizes them according to greatest necessity and urgency. Maintenance of the present system requires a major portion of the budget and in these economic times, expansion will be a challenge.

Valley City State University is a place where boundaries are always challenged, barriers often removed, and learning continues to be re-evaluated. The strategic plan emphasizes customized learning defined as "learning that enables each person or organization to have effective, convenient, and efficient access to an educational process that supports independent progress toward their goals." This vision provides strong impetus toward change and adoption of technology into every aspect of the university community—including music. Many music projects utilizing technology are integrated now and have received positive feedback from students involved. As the university moves forward, the hope of the music department is that monies will be available to upgrade equipment and performance facilities, provide software to each laptop as needed, and maintain solid support for building on a traditional program as well as in the technological arena. As a whole, the music faculty feel the need to "get on board" with the vision and mission of the university as good team members. However, there is lingering uneasiness about the future of a traditional music program for the preparation of K-12 teachers in this innovative environment. The unanswered question is when tradition meets technology, is there a clear winner or loser? Can the two be truly compatible or will the one with the most momentum usurp the other?

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TEACHING IN THE INFORMATION AGE: THE CREATIVE WAY!

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Abstract: Are students uninterested in the study of computing? Do they complain that computing is "dry" or that the subject matter has no relevant application to the "real world?" Do they seem frustrated, bored, and inattentive? Your mission as a creative facilitator is not to assign a grade; your mission is to educate students to think, to learn, and to make new connections that they never before thought possible. A teacher's guidance, constructive feedback, and facilitated instruction should pave the way for students to meaningfully bridge prior knowledge with new knowledge. In this paper, the authors suggest how teachers might teach creatively, particularly with respect to computing curricula, while they enjoy the teaching and learning processes.

1. Teachers: Can Be Prophets Of Creativity!

A teacher's primary mission is not to assign a grade; it is to educate students to think, to learn, and to make creative connections that they previously thought impossible (Hamza, 1996; Hamza, 1998; Torrance & Safter, 1990). According to Lowman (1984), teachers who are successful in these approaches are extraordinary; they advocate intellectual excitement, they build trust, and they foster a sense of sociability. In addition, studies by Alexander and Knight (1993) suggest that the learning environment traditionally called the "classroom" should be interactive, dynamic, interesting, and thought provoking. To accomplish these goals, a teacher must be a tolerant facilitator, a passionate educator, and an involved decision-maker. When using computers in the classroom, set aside the traditional instructional approaches that base grading systems on dull memorization, conformity, and authority (Jonassen, 1996). Do not "force-feed" information or create all possible associations. Mentioning information replaces teaching; it conjures the "illusion of learning" and the "illusion of teaching" (Durkin, 1978-79). Find alternative ways to evaluate achievement and invent instructional objectives that are based on thinking, learning, and practical performance. In safe, nonthreatening environments, students learn are more successful in identifying concepts and applying rules to real problems. When teachers acknowledge goals, interests, and cognitive skills, students will also be more likely to produce higher order thinking and problem solving.

Remember to treat students with respect as young colleagues. Try to observe other creative, innovative classrooms. Attend creativity conferences and network with others who promote creativity (Kauffman & Hamza, 1998). Show optimism, a sense of humor, and a casual attitude. Build upon non-threatening, flexible, and creative environments; encourage questions, opinions, and teamwork. The preservation of our way of life and our future security depends upon our most important national resources, our intellectual abilities and, more particularly, our creative abilities. Now is the time to learn all we can about those resources (Guilford, 1959, p. 2).

2. Learning Domains: Educating the Mind!

Learning objectives should dictate instructional strategies, whether specifically focused upon the accomplishment of lessons or the result of larger course objectives. Because scholastic marks are not absolute indicators of knowledge, "B students" may be more knowledgeable than "A students." Therefore, probe their incoming skills to determine the overall mixture of knowledge and understanding. Ask students how they learn best and what events would make the class the best or the worst class they will ever take.

You might also ask them what computing classes they have taken. Do they have a computer at home and are they "online"? What types of software packages or programming languages have they used? As designer of this creative environment, your goal is to portray an overall picture of your students' expectations, their skills, and their learning strategies. When you learn more about them, you can flexibly design instructional objectives, strategies, and assessments to meet student needs and achieve learning outcomes (Gagne, Briggs, & Wagner, 1992; Smith & Ragan, 1999).

Work backward from expected learning outcomes to achieve instructional goals. Do not emphasize concepts over hands-on learning or vice versa. Hands-on learning may appear to be the most potent form of computer education; however, it only produces temporary gains because perpetual changes in computing software result in profusions of market upgrades. Therefore, students must also learn the logical, systematic thinking of programming and basic information systems theories in order to transfer domain-specific knowledge to newly acquired information- thus, connecting prior knowledge to new knowledge in a meaningful way. When you acknowledge the following learning domains, you not only train and lecture, but you also teach and educate the whole person: 1) cognitive strategy (capabilities that influence the learner's own learning and thinking behavior); 2) psychomotor skills (coordinated muscular movements); 3) verbal information ("knowing that," i.e., to recall verbatim, to summarize from facts, names, dates); 4) intellectual skills ("knowing how," i.e., the application of relational and procedural concepts and rules to solve problems); and 5) attitudes (similar to cognitive strategies, a mental state that predisposes a learner to selective behavior.

3. Enthusiasm and Interest: Can you spark it?

When students are inattentive in class, they are most likely dreaming of doing something that interests them. Therefore, your enthusiasm and attitude set the tone of your classroom. Make learning fun, stimulating and productive. Knowledge is animated, constructed information that is meant to be shared but not possessed (Perkins, 1986). Consider the following examples. Ask students greet one another each class period and encourage them to share personal experiences, including success and that which they perceive as failure. Liven social skills and self-management in the form of card games from reading assignments. Assign projects that spark interest in the systematic analysis of web sites based on selected criteria, i.e., user friendliness, content quality, cognitive applicability, management, and effectiveness. Ask students to share analyses and incorporate findings. Motivation is greater when they can associate new material with tangible events. Foster problem solving skills and innovative thinking; ask students to divide into small groups based on opinion surveys that result from an interesting topic. Stir interactive, controversial debate. Present questions, ideas, and disputable issues, and encourage new intellectual horizons to build communities of learners that offer positive attitudes aimed at higher achievement and quality production (Karre, 1994). Scenario creates interest in subject matter and defines applicability to subject content associated with real world problems, computer issues, and concerns. Students are more likely to enjoy creating a personal expense account spreadsheet or a profit and loss statement of a virtual business plan while they use the "what if analysis" than if they complete a meaningless assignment that only awaits a grade.

4. The Fun of Perceiving the Power of 2!

Long rumored to be an unenlightening, straightforward task, explaining the power of 2 can spark sheer imagination. For example ask students, without using a calculator, to guess the thickness of a .1 mm paper if folded in half 25 times. Indeed, were it not for the impossible mechanics of folding it, the paper would be 3.35 kilometers thick. A few more folds and it would measure in hundreds of kilometers!

The binary system represents number quantities similar to the decimal system, in that the decimal system uses ten digits, 0 through 9, and the binary system uses only 0 and 1. The value of a decimal number is calculated as a sum of weighted powers of base 10. For example, $3079 = 3\,(10)^3 + 0\,(10)^2 + 7\,(10)^1 + 9\,(10)^0$ or $379 = 3\text{x}1000 + 0\text{x}100 + 7\text{x}10 + 9\text{x}1$. In the same fashion, binary numbers are evaluated as follows: $1101 = 1\,(2)^3 + 1\,(2)^2 + 0\,(2)^1 + 1\,(2)^0$ or $1101 = 1\text{x}8 + 1\text{x}4 + 0\text{x}2 + 1\text{x}1$ = (13 in decimal).

To represent the power of 2, one binary digit assumes two possible forms (i.e., 0 and 1). To represent twice as many, you use a second binary digit (i.e., 00, 01, 10, 11). Therefore, decimal number 13 can be represented in binary as 1101, a more storable numbering protocol of 0's and 1's in the computer. The display on the printer or monitor screen is converted back to the original decimal digits, which require 10 different electronic states. To further represent twice as many, you use a third binary digit (i.e., 000, 001, 010, 011, 100, 101, 110, 111), and so on. Thus, every time you need to double the possibilities (multiply by 2), you add one more digit. In contrast, whenever, you need to reduce the possibilities by half (divide by 2), you eliminate one digit. To spark curiosity, ask students to think of a concealed number that you will guess with the help of the binary system. You might first ask students to think of a number from a range of numbers between (1 and 8). Suppose the concealed number that the students chose is number (6). Your first guess is going to be the median of the range, number [4].

Then ask if the concealed number is less or equal (<=) than number [4], or greater than (>) number [4]. The answer is: greater (>) than number [4]. Next, eliminate half of the numbers of the original range (eliminate 1-4). Now, state your second guess [6], which is the median of the remaining range (5-8). Then ask if the concealed number is <= or > your second guess. Their reply will be <= number 6. State your third guess [5], the median of the new range (5-6) after eliminating the other half of the remaining range (eliminated 7-8). If the concealed number is <= or > than your third guess, then 6 is the concealed number.

5. Divergent Imagery: Mindmapping Tools & Brainstorming Techniques

Divergent imagery is the external mirror to radiant thinking that powerfully unlocks ultimate thinking; it enhances thinking potentials, it generates multiple ideas, and it organizes associations between new and prior knowledge. Mindmapping, a feature of divergent imagery, has four essential elements (Buzan & Buzan, 1993; Jonassen, 1996): 1) the subject of focus crystallized in a central image; 2) major themes of the subject radiating from the central image; 3) topics of importance represented as branches attached to more and lesser important branches; and 4) all branches form a connected nodal infrastructure. Mindmapping attempts to meaningfully connect two or more things that seem to be logically and rationally impossible to link (Dacey, 1989; DeBono, 1992), and is designed to produce individual high-quality convergent solutions from divergent productions. Making the strange familiar and the familiar strange, ambiguity is a central component that provides impetus for divergent, creative thinking.

Exercises that combine the use of mindmapping and divergent imagery provide the theoretical basis of content, including practical experience from the use of alternative radiant thinking and cognitive strategies that elevate intellectual skills. Consider the following examples to use with your students: (1) Encourage them to find, through small group interaction, twenty ways that commonly used computing technologies might be applied to negative situations or to new relations and associations among objects, people, data, facts, technologies, concepts, and theories. (2) Have them explain input, processing, output (IPOS) using unrelated objects, data, and technologies: vegetables, EZ pad, and PC card TelePath data/fax modem. (3) Ask them to create a visual commercial that promotes an alternative way to use PC electronic communication followed by a drawing of their solution(s) based on divergent imaging techniques. (4) Ask them to form small groups and create a mindmap that solves a given problem. A chosen leader in each group must ring a bell when criticism occurs. Welcome all ideas, no matter how silly, funny, or wild. Suggestions are tape-recorded or written to enhance each contribution. After they exhaust all possibilities, they evaluate suggestions by explaining the process that led to the solution, which includes a metaphoric concept map. (5) Ask them to quickly and silently, create 15 different associations from the word "education" as the center image of a mind map. Later, they will be amazed at their varying responses. (6) Ask them to create new associations between already existing associations (the word "Internet") to solve a problem, initiate a project, or see a new point of view (Jonassen, 1996; Hamza, 1998). Divergent imagery programs are now available to assist in producing such mental graphics [1].

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[1] Visible Systems Corporation, http://www.visible.com;
ParaMind Software, Inc., paramind@aol.com;
Inspiration Software, Inc., http://www.inspiration.com;
SemNet Research Group, 1060 Johnson Ave., San Diego, CA 92103;

6. Computers as Cognitive Tools: Learning Critically and Creatively

"Computers are useless; they can only give you answers" [2]. Computers should be the mental and computational guides that promote all aspects of human thinking (Jonassen, 1996; Simons, 1993). Hence, students are able to synthesize, categorize, and process meaningful information. Thereafter, they can reflect on what they know, they can create new connections, and they can subscribe to new learning goals.

To make the class more challenging, creative, and germane to daily living, ask for the fastest way to add 16 numbers. A quick reply might be to use the fastest adder (computer) in the world, which would take 16 linear steps to add the 16 numbers. However, there are many other faster mechanisms. Encourage students to think divergently and in parallel form. Students might use 8 adders in which each adder sums two numbers to add the 16 numbers. Eight pairs of numbers will produce 8 partial sums, followed by 4 adders to add the 8 partial sums to produce 4 partial sums.

Third, use two adders to add the 4 partial sums to produce two partial sums. In the fourth step, use one final adder to add the last two partial sums to produce the final sum. Students will be amazed by the speed of adding 16 numbers in just four steps using parallel adders. You can challenge them further by asking, "How many adders do we really need?" Many students will reply, 8+4+2+1=15; however, only 8 adders are needed because we never used more than 8 adders at the same time. Now, you ask about the relationship between the numbers being added (N), the number of adders being used (A), and the number of steps it took to compute the final sum (n). The answer is $N=(2)^n$ or $16=(2)^4$ and A=N/2 or 8=16/2. This discussion will most likely enhance rational thinking, reasoning abilities, and overall creativity (see Fig. 1, Binary Tree).

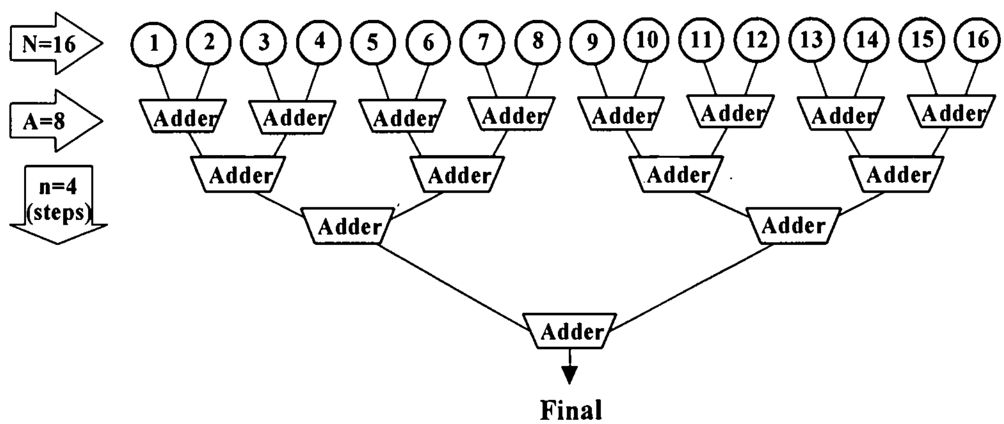

Figure 1: Binary Tree. The binary tree is a quick, graphic example that will most likely enhance rational thinking, reasoning abilities, and overall creativity. Eight pairs of numbers will produce 8 partial sums, followed by 4 adders to add the 8 partial sums to produce 4 partial sums. Use two adders to add the 4 partial sums to produce two partial sums. Use one final adder to add the last two partial sums to produce the final sum.

Continuous change pressures society's brightest individuals to quickly sort information, categorize it, connect it, and provide divergent solutions. Therefore, students must learn to manage ambiguous situations, challenging tasks, open-ended assignments, and tasks that seem impossible to complete. According to di Sessa (1988), an educated citizen in the year 2020 will be able to produce more builders of theory, synthesizers, and inventors of strategy and increasingly fewer will be employed as managers of fact. Provide tools that allow students to learn how to manage these complex tasks. Lead them to the rim of thinking and insightfully encourage them to take risks.

[2] Pablo Picasso.

7. Education and Technology: Students as Explorers

Technology can be the impetus that propels your students' imaginations and cognitive satisfaction in the classroom. Successive updates in Internet software and video conferencing, technology's unlimited capacity, and its growing popularity should support all aspects of instructional and educational goals. Students should investigate, share, and construct knowledge individually and together as a team. Encourage students to explore complex computer concepts through participation in small application groups that involve development and debate.

Encourage them to think critically and creatively (Hamza, 1996). Engage them in problem solving, analyzing, and synthesizing computer related theories, problems, and challenging tasks. With your guidance and positive feedback, encourage students to create project proposals and solutions to apply what they learned in class to real, pragmatic problems. Provide continuous, constructive response to excite them in the discovery process. For example, students can learn HTML (hypertext markup language) coding through classroom projects where they create a Web site about a topic that interests them. Ask them to design a proposal that should conceivably meet the demands of their employer (real or virtual) or the needs of the community. As an alternative, they can make the web design project a controversial subject, such as the fight against tobacco legislation or child pornography. As they construct their web page, challenge them to embed various emerging technologies: sound, 3D graphics, two-way audio, or two-way video. Encourage them to write a list of topics that provide interesting material for their projects. Ask them to share their thoughts not only with each other, but also with other students from the global community via the World Wide Web.

8. The Rewards of Creative Behavior and Risk Taking

Encourage students to try something new and help them realize that failure is a necessary challenge in the seamless transition to success. Do not penalize students when they make mistakes; encourage them to search for divergent solutions. Humor is a vital catalyst to this process. When students are afraid to press a computer key or to explore new programming or math concepts, you might reassure them with a funny phrase such as, "It's OK to touch the keyboard – it *won't* eat you for lunch!" Students enjoy earning bonus points toward the accomplishment of assignments and projects. Motivate them by rewarding their creativity and dedication, but be aware of your own defensiveness. Students are unlikely to think creatively if they feel threatened. Encourage them to get feedback on their solution from others who are less personally involved. Ideas must be given a chance to incubate; it is important that you give students time and flexibility in order for them to glean new ideas and associations. When students see you having fun with the subject, they will be more willing to think, to learn, to explore, and to solve problems.

9. Conclusion

Teaching creatively for effective learning demands a migration from inherited practices of instructing, thinking, and using computers as mere drill and practice appliances. The ultimate goal of all teachers should be to facilitate the use of computers and computing technologies as mind tools (cognitive tools) to accompany thinking, reasoning, creating, learning and inventing. You may wish to try a few of the suggestions in this article and continue to include other suggestions as you feel comfortable in making additions. Avoid using "filtering" processes that block awareness. Help students to become more involved with practice exercises that regard problems as opportunities to uncover solutions. Encourage students not to conclude their search from the first solution; encourage them to generate numbers of possible solutions and select the best solutions from the group. After all, you are the prophet of creativity!

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Linear Multimedia Benefits to Enhance Students' Ability to Comprehend Complex Subjects

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Abstract: Living in the information age has increased the complexity of our forms of communication, especially in education. Computer-controlled combinations of text, graphics, sound, photographs, film, and other types of media have surrounded our lives, thereby transforming the traditional educational process. In spite of the allurement of these sophisticated, modern communication systems; laserdiscs, videofiles, CD-ROMs, etc., these materials enhance, rather than replace, the traditional teaching style. Nonetheless, educators are challenged with creating innovative contexts for learning that expand the students' ability to recall and comprehend complex subjects in a competitive, media-communication environment. There are two, major categories of multimedia; non-linear or interactive and linear. Both utilize similar elements: text, graphics, animation, sound, and video. Video production is considered linear multimedia. This research measures the students' ability to recall and comprehend complex subjects utilizing linear multimedia and its benefits.

Introduction

Designing an ideal environment to teach and learn sciences requires a considerable effort of educators. The subject's inherent complexity challenges the educator's ability to explain and interest the students at the same time. In spite of the technology's advancement, teaching science is still complex even if the digital and multimedia resources have redefined literacy and learning (Negroponte, 1995).

The information age has increased the complexity of our forms of communication, especially in education (Casey, 1997). Computer-controlled combinations of text, graphics, sound, photographs, film, and other types of media have surrounded our lives, thereby transforming the traditional educational process. In spite of the allurement of these sophisticated modern communication systems; laserdiscs, videofiles and CD-ROMs as well as other supporting technologies, these materials enhance, rather than replace, the traditional teaching style. The technologies that surround us need to effectively support the teacher's central role in orchestrating the learning experience instead of replace it. The new digital communication tools present a potentially richer opportunity to use images in movement instead of traditional print media to explain complex subjects. In addition to learning and understanding sciences, other forms of communication can be utilized to promote an interest to learn, including animation.

Character animation is the basis of most children's primary choice of entertainment. Television, feature films, video arcade games, and home video games are probably the most popular media venues in the market. Despite their respective popularity, animation production is a time-consuming task, requiring skilled professionals and specialized equipment. Because of this fact, most available educational productions are developed in what is known as non-linear or interactive multimedia. CD-ROMS and WEB browsers are included in this multimedia category. Users of this technological development control the content and go to any part of the application at any time. This feature confers independence to the user, which may result in an unstructured learning environment.

Linear multimedia, such as video production, utilize the same elements as non-linear multimedia applications; text, graphics, animation, sound and video. Linear multimedia presents information in a logical, systematic sequence, allowing the educator specialized or standardized support for group exposure to complex elements at any particular time.

This paper describes the first phase and results of a program whose main objective is to produce animated educational material to stimulate the students' interest and learning process of the sciences and measure their impact. The program material is designed to support middle school educators with an effective, accessible and novel, didactic tool produced specially to enhance and encourage the learning of Chemistry.

This study introduced the Periodic Table of the Elements, specifically developed for middle school students in two distinct formats: A printed narration, and an animated video with an English or Spanish language narration. The results compare the difference between the students' ability to recall and comprehend complex subjects as presented by linear multimedia as opposed to printed text. The study additionally offered an opportunity to observe the advantage of applying a narrative format to procedural text. The study was performed in the border region between USA and Mexico in the cities of El Paso, Texas and Ciudad Juarez, Chihuahua, Mexico.

Methodology

Materials

An animated videotape and printed material were the primary instruments of the study. Both utilized a format that combines narrative and descriptive text. *Narrative text* includes a recital of facts and *descriptive text* a series of sentences describing objects or persons and a series of events that cause a change in state (processes) around a common theme (Large et al. 1995). According to some studies, animation has been found to enhance procedural texts (a series of actions executed by someone or something to achieve an explicit goal) but not descriptive texts (Large et al. 1994). The narrative of the videotape has the basic structure of a drama, including characters, setting, conflict, and resolution. The protagonist, a child in a wheelchair, was a medium for the audience to empathize with the difficulties in understanding and learning. The videotape is organized in blocks. At the end of each block, the essential concepts are summarized and reemphasized. The videotape introduces the structure of the elements, Dmitri Mendeleyev's first organization of the periodic table of the elements, the current organization, and gradually explains more complex subjects. The more detailed information includes; the elements' physical and chemical properties, the arrangement of electrons in the orbits or energy shells, valence, reactivity, and the differences between the groups or families.

Videotape

A ten minute, fully animated videotape with an English or Spanish language narration, featuring a child in a wheelchair researching the Periodic Table of the Elements. The English version of the videotape was shown only in the United States schools and only the Spanish version was shown in Mexico.

Written Material

The narration from the videotape was used as a basis for the printed material. The only difference between the videotape narration and the printed text was the omission of references to the protagonist. These exclusions were irrelevant to the primary concepts and would be confusing without a visual reference. For

example, the animation depicts a scene where the main character becomes dizzy from attempting to memorize all of the chemical elements.

A Spanish language equivalent of the written text was produced from the Spanish version of the videotape, as opposed to translating the English printed text. The text consists of approximately 815 words without any images.

Questionnaires

Ten, multiple choice questions were included in both the Spanish and English language questionnaires. The questionnaire progressed from simple questions to more advanced. A clear understanding of the material was required, as the various choices were very similar, yet only one was the correct response.

The following is an example:

Lithium has three electrons. This means:
1. The first orbit has one electron and two electrons in the 2nd orbit
2. The first orbit has two electrons and only one electron in the 2nd orbit
3. The first and second orbits have one electron each and one in the third orbit
4. Do not know

Groups

Students from 8th grade in the US group and from 6th and 7th grades in the Mexican group participated in the study. The same grade level was not included in both countries, because the Mexican curriculum begins the study of Chemistry in the middle of the 7th grade. The students required no prior knowledge of the study of the Periodic Table of the Elements to participate in the study. For that reason, the students were drawn from the 6th and 7th grades in Ciudad Juarez, Chih. and from the 8th grade in the El Paso Area. The schools have different curriculums and facilities, despite the huge difference between the two countries economies, the students belong to similar socio-economic environments with respect to the rest of their respective area population.

A total of 320 students participated in the study, with the majority belonging to the Mexican group. This was due to the difficulty in finding similar socio-economic environments between the public schools in Mexico and the US.

School	Country	Group	Grade	N
A	US	Written Material	8th	23
A	US	Videotape	8th	27
B	Mexico	Written Material	7th	74
B	Mexico	Videotape	7th	83
C	Mexico	Written Material	6th	59
C	Mexico	Videotape	6th	53

Table 1: Group distribution by country and grade level.

Procedure

The students were explained the purpose of the study and randomly assigned to six groups with roughly equal numbers of boys and girls. Two groups from each grade level were assigned 10 minutes to either watch the videotape or to read the written material. Once they finished reviewing the material, the reading group returned the printed material and both groups received the questionnaire. Both groups were allocated 10 minutes to complete the questionnaire and return them.

Results

United States

Participants who viewed the videotape scored significantly higher on the questionnaire *($t = 4.0$; $df = 48$; $p < 001$)* than those who read the printed version of the material.

8th grade	Mean	Median	Mode	N	Std. Deviation
Printed	7.30	7.0	8.0	23	1.61
Video	8.89	9.0	10.0	27	1.19

Table 2: Descriptive of 8th grade students in the United States.

Mexico

No significant difference was found between the responses of the groups that read the material and those who viewed the videotape *($t = 1.473$; $df = 268$; $p = 0.142$)* .

6th and 7th grades	Mean	Median	Mode	N	Std. Deviation
Printed	5.83	6.0	7.0	134	2.21
Video	6.20	6.0	6.0	136	1.92

Table 3: Descriptive of 6th and 7th grade students in Mexico.

Participants from the 6th grade *($t = .470$; $df = 110$; $p = 0.640$)* and 7th *grade ($t = 1.302$; $df = 156$; $p = 0.195$)*, who viewed the videotape did not scored significantly higher on the questionnaire than those who read the printed version of the material.

6th grade	Mean	Median	Mode	N	Std. Deviation
Printed	5.15	5.0	4.0	59	2.04
Video	5.34	5.0	5.0	53	1.69

Table 4: Descriptive of 6th grade students in Mexico.

7th grade	Mean	Median	Mode	N	Std. Deviation
Printed	6.36	7.0	7.0	75	2.04
Video	6.75	7.0	7.0	83	1.69

Table 5: Descriptive of 7th grade students in Mexico.

Discussion

The majority of students who watched the animation in the United States (37%) answered all multiple-choice questions correctly, as opposed to 8.7% of those who only read the printed material. Despite the reading group's lower percentage of perfect scores, the overall results were high, considering the complexity of the subject matter. These results suggest that the use of a narrative format in printed material can potentially improve understanding and the learning process (Rothkopf, 1966).

The 6th and 7th grade students in Mexico showed no difference in age or gender between those watched the videotape and those who read the printed material. The scores indicate a significant difference between the two grade levels *($t = 5.441$; $df = 268$; $p = 0.001$)* that confirm the material would be more appropriately implemented in the 7th or 8th grade levels.

The students in Mexico had a wider distribution of responses, ranging from no correct answers to perfect scores. Whereas none of the participating students in the United States scored less than 50% correct answers.

Conclusions

The main purpose of the program's first phase was to determine the effectiveness of animated video material to enhance a descriptive text and improve the students' ability to comprehend complex subjects. The main objective of the second phase will be to contrast and compare the benefits between animated and printed material when used as didactic tools supporting educators in the instruction of complex subjects.

There is a significant difference between the Mexican groups who scored less than five correct responses after viewing the animated videotape as opposed to those who read the printed material. The correct responses recorded from their questionnaires corresponded to the most complex questions in the instrument, suggesting the presence of distractions during the testing. The large number of students and the small classrooms resulted in distractions while the participants answered the questionnaires. There is evidence to suggest the information process is affected in the presence of distractions. The public schools in Mexico do not have the facilities to minimize such distractions but the private schools frequently do.

Mexico's middle class has turned to the private sector for the education of their children. Many of the school's installations and equipment compare to the settings of the US public schools, suggesting the results of this study may differ in a more controlled environment.

In both countries, the students appeared to be more attentive to the animated material. Linear and non-linear animation has flourished in recent years warranting a place in the future of education. Other studies have indicated a significant advantage in applying animated material (Nicholls, et al. 1996). Further research will determine the optimum method for combining linear and non-linear animated material as a didactic tool, augmenting, instead of superseding the existing curriculum, while encouraging the students' interest to learn and study.

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Lone Star 2000: Technology for Today

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Abstract The Lone Star 2000 Project is a university-school system collaboration between the Duval County Public Schools in Jacksonville, Florida, the Division of Curriculum and Instruction in the College of Education and Human Services at the University of North Florida, and three business partners, including the IBM Corporation, Logical Business Systems and MediaOne. This five-year project has emerged as an effective model for successfully infusing technology into classroom teaching and learning with a measurable, positive impact on student achievement.

Project Overview

The Lone Star 2000 project is a five-year collaboration between Lone Star Elementary School of the Duval County Public Schools in Jacksonville, Florida and the Division of Curriculum and Instruction of the College of Education and Human Services at the University of North Florida, and three business partners, including the IBM Corporation , Logical Business Systems, a local IBM K-12 Division Business Partner, and MediaOne, a nationally known cable company. Lone Star 2000 is designed to improve teaching and learning skills in college and K-12 classrooms through the use of educational technologies. During the 1998 spring term, 5 Lone Star Elementary School teachers, a science resource teacher, 5 UNF teaching interns, a UNF professor and an IBM/LBS technology trainer participated in the project. Three of the teaching interns were assigned to first-grade classrooms, one to a third-grade classroom, and one to a fourth-grade classroom.

In early February the interns received two days of training in the use of IBM educational courseware. Topics covered during the two-day training included: Teaching and Learning with Computers (TLC), the IBM approach to classroom instruction; an introduction to IBM science and language arts instructional courseware; and a multimedia authoring system. In March, the interns received a third day of training on the specific details of electronic portfolio development.

Training consisted of hands-on instruction in the use of IBM computers, a large-screen projection device, and curriculum-based IBM courseware, including *Write Along, Stories and More II, The Nature of Science-Through the Woods and LinkWay Live!* The teaching interns learned to use this IBM educational technology to present whole class lessons to students and TLC techniques for utilizing the computers for pair and small group learning center instruction. In addition, they learned how to use *Write Along* and *LinkWay Live!* to creatively produce electronic portfolios and direct the development of linked electronic folders of student work.

Project Focus

The focus for the fifth year of the project was on utilizing technology to present integrated language arts and science curricula to students in innovative, dynamic ways and documenting student learning through personal electronic portfolios linked to student electronic folders. The emphasis was on direct, simplified, training for interns and the efficient application and transfer of skills to their students. As a special feature, Mr. Jack Neilly, a local author of the book, *Larry the Lightning Bug and the Lighthouse Adventure* donated copies of his book to the students in the 5 participating classrooms. The book was used as part of the integrated language arts and science focus of the project. At the conclusion of the project, Mr. Neilly participated in a "Technology Sharing and Meet the Author" event for students, parents, interns and teachers.

Project Goals

Participants in the project:

X Learned to use multimedia computers for creating presentations and for instructional activities.

X Learned to use software, courseware, and related technology-based materials available at Lone Star for classroom teaching and learning activities and IBM s TLC approach to facilitate their effective use.

X Became knowledgeable about the available technologies for use with a single computer to present whole-class instruction while successfully conducting technology-infused lessons.

X Learned to use the multimedia presentation tool, *LinkWay Live!*, an enhanced teaching and learning tool for creating learning materials which included text, video, sound and graphics.

X Used *LinkWay Live!* to create personal electronic portfolios showing what was learned about educational technologies. Portfolios included such artifacts as pictures, lesson plans, diary of technology experiences, and samples of student work.

X Assisted students in creating electronic folders of their work using *LinkWay Live!* and *Write Along* to document their new technology skills as well as their knowledge of subject matter. Student folders included student art, writing, sound, and pictures.

* Created a two-week, technology-based unit plan with cross-curricular connections for language arts and science utilizing the book, *Larry the Lightning Bug and the Lighthouse Adventure* and courseware from IBM=s *Stories and More II* and the *Nature of Science – In the Woods*.

* Participated in a Technology Sharing and Meet the Author event for students, parents, interns and teachers , displaying their electronic portfolios and the electronic folders of their students.

Research-base for the Project

The studies which follow helped provide a practical and useful framework for identifying key factors that were used as benchmarks for the project.

1. Clearly defined goals were identified. Reeves states that "Technology infusion as well as other restructuring activities should be driven by clear goals." Goals for this project involved "authentic achievement" for preservice teachers in the form of electronic teaching portfolios and electronic student folders, videos clips of teaching and learning, and professional conference presentations. Newman supports this approach to the project by saying "Rather than reproducing knowledge, students should be involved in producing knowledge, through discourse, through the creation of things, and through performance."

2. Thorough documentation of all phases of the project were accomplished to provide a clear understanding of how the project started, its development, and its evolution. Reeves states that "Documentation attempts to capture all the changes that occur in the process of reform so that interested participants can understand what is really occurring."

3. Formative experimentation is defined as follows: "In a formative experiment, the researcher sets a pedagogical goal and finds out what it takes in terms of materials, organization or changes in the technology to reach the goal." Over a five year period, the Lone Star 2000 Project adapted and restructured to incorporate new technology, new knowledge, and improved methods for meeting the project goals.

4. Impact evaluation is defined by Reeves as "attempts to assess the effects of innovative instructional practices on factors such as organization, climate, teacher and student self-perceptions, parental and community aspirations, and numerous other difficult-to- measure factors." The Lone Star 2000 Project used traditional and non- traditional methods of assessment to measure progress toward its goals.

Several outcomes of the project were also based on research by Rogers who identified some important ways in which the adoption of interactive communication innovations differ from processes used in other kinds of new ideas.

1. Critical mass of adopters

The Lone Star 2000 Project began with two very interested teachers and two interns as a core group to influence additional school personnel to gain new knowledge about new educational technologies instructional strategies for using them in their classrooms. Rogers states that "the usefulness of a new communication system increases for all adopters with each additional adopter." Over the past five years, 12 teachers, 5 principals, 5 university professors and teacher trainers, 31 teaching interns and 910 students in 12 K-12 classrooms participated in the project.

2. Degree of use

Continued, supported use of the educational technologies by teachers was critical to their eventual classroom infusion and diffusion to other users. Rogers states that "The degree of use of a communications innovation rather than the decision to adopt it, is the dependent variable that will indicate the success of the diffusion effort."

3. Re-invention of the innovations

Rogers states that "The degree to which an innovation is changed or modified by a user in the process of its adoption and implementation is essential to its infusion. The innovation was infused into classrooms when teachers and interns were able to successfully design and implement instructional activities using educational technologies that met their own specific needs and those of their students.

Project Outcomes

Over the past five years participants have produced the following outcomes:

Formal and informal observations

Multiple observations have been conducted for each preservice teacher during the course of their internship experience by their directing teachers, school principal and university supervisor.

Journals (process portfolios)

The preservice teachers have produced weekly journals of their teaching experiences in the classroom, including a description of the educational technology training they received and how the IBM software was integrated into the curriculum at their grade level. Their reports include the ways in which they implemented their knowledge of educational technology in the classroom for instruction and how it related to Florida's Sunshine Standards.

Videotaped lessons

The preservice teachers produced videos of their delivery of student classroom instruction using IBM technology. Their videos were used for formative assessment as well as product outcomes to demonstrate their effective use of technology to enhance classroom teaching and learning.

Electronic student portfolios (product portfolio)

Each preservice teacher and their students created electronic portfolios with *LinkWay Live!* that used text, sound and graphics to illustrate their knowledge of various subject matter learned as well as their increased knowledge and skill in the use of the educational technology.

Interview questionnaire for directing teachers, principals and teaching interns

The questionnaire included the level of comfort in using the technologies; responses of students toward the technology in terms of attitude and performance; observations of parent reactions to the student's technology use; and the degree to which the IBM courseware assisted interns in delivering instruction in various curriculum areas.

Preservice teachers participating in the project have been successful in securing teaching positions.

More and more classroom teachers are using the new hardware and courseware.

There has been an increased parent interest and involvement demonstrated by participation in special training for parent technology volunteers and in their subsequent service in the classroom. Also, a Technology Night which showcased Lone Star student's electronic portfolios was attended by over 100 parents.

Business partner funding was received for courseware, hardware, fiber optic cable, and considerable technical support.

Increased number of technology grants applied for and received
Based upon the documentation of positive results of evaluations from the previous years and a clear implementation plan, project participants have been successful in receiving education grants to further this educational technology project. A 1998-99 Challenge Grant was awarded to connect the work at UNF and Lone Star with a suburban high school, an inner city elementary school and an inner city high school.

A CD-ROM electronic professional portfolio was produced. [On-line] Available: http// : www.unf.edu/coehs/faculty/dholt/develop.html

A CD-ROM disc documenting the fifth year of the project was produced.

Distance learning connections were established between the COEHS Educational Technology Center at the University, the Science Resource Room at Lone Star Elementary School and a Science Technology Laboratory and Chemistry Classroom at Sandalwood High School. Four distance learning demonstrations were completed between the university and the school sites. [On-line] Available: http://www.unf.edu/coehs/cpbgrant/ Advanced placement chemistry students at Sandalwood High School continue to make science presentations to Lone Star students.

Conclusion

The Lone Star 2000 Project has enabled participants to discover that educational technologies are powerful and effective teaching and learning tools. Participants have also learned that university and public school personnel, working together within partnership schools can help bring barriers down, develop visions, change perspectives, and become open to permanent change.

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A Collaborative Effort in Building the National Educational Resource Center

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Abstract: The National Educational Resource Center (NERC) has been established since February 1998 in a multi-million U.S. dollar national project to promote usage of computing and telecommunication technologies in the K-12 schools across all subject areas. The NERC's main responsibility is to provide a rich set of educational resources for the teachers to use in their classroom instruction. In the initial stage, there are 39 regional resource centers helping to develop and to collect educational resources in all subject areas in K-9 grades. Ten months into this project, available resources in the NERC is growing rapidly. In this paper we present the collaborating framework of the national and the regional resource centers, describe the content structure of all the resources and share our experiences in the running of the National Educational Resource Center.

Introduction

The use of Internet resources for instructional purposes has become a new trend of educational innovations. The Internet brings unparalleled powers of immediacy and individualization to the classroom curriculum. It may change the educational practices in three ways: enriching the existing curriculum, extending the existing curriculum, and transforming the curriculum (Dyrli & Kinnaman, 1996a, 1996b). Many educational Internet activities have been proposed and implemented for teachers to use in the classrooms. Harris (1998) classified the Internet activities into three groups: interpersonal exchanges, information collections and analysis, and problem solving. Under the three groups are 18 major activity structures that can be used by teachers to design their classroom projects. Hackbarth (1997) provided guidelines for conducting and evaluating the web-based activities. Furthermore, some educators screened the overwhelming educational resources that are available on the Internet and organized them in some meaningful ways; thus, providing portal gateways for educators to access Internet educational resources. For example, Slattery et al. (1998) collected activities and lesson plans from the World Wide Web and showed how they can enrich science teaching. A comprehensive collection of the web sites for educators can be found in Dyrli's (1996) article. In contrast, availability of Chinese-based educational resources in Taiwan is very limited. It is necessary to gather a wealth of educational resources before the teachers can use them effectively in the classrooms.

Internet access has increased dramatically in all levels of schools in Taiwan under the support of the government's National Information Infrastructure project. The Ministry of Education (MOE) of Taiwan has launched a multi-million U.S. dollar project to promote the use of computing and telecommunication technologies in the classrooms and in teaching across all subject areas. On the hardware side, this project will provide sufficient funding to all K-12 schools so that they will have access to the Internet through the Taiwan Academic Network (TANet) by year 2000. Construction of the physical network infrastructure for all K-12 schools is ahead of schedule. It is now expected that all schools will have access to the Internet by June of 1999. With the aid of network technologies, it is hoped that the educational resource gap between urban and rural schools may be bridged. On the software side, availability of the Chinese educational resources on the Internet is very limited. Without a rich set of suitable educational resources for use in the classrooms, merely having Internet connections provides no educational value for the teachers or the students. Thus a separate project, based on collaborative effort among selected K-12 schools, has been under way since early 1998 to

amass educational resources in various subject areas and to make them available to all K-12 teachers over the Internet. The National Educational Resource Center (NERC) was established under this project to ensure that the quantity and more importantly, the quality, of educational resources amassed is useful to the teachers.

The Collaborative Framework

To carry out this project, MOE established the National Education Resource Center (NERC) and funded thirty-nine schools to serve as the regional resource centers in the first year. Each resource center is responsible for providing teaching resources in one or more subject areas in K-9 grades. Subject areas in the elementary school and junior high school curricula, including Chinese, English, Mathematics, Biology, Arts, Physical Education, and others, are all covered. Since each of the regional centers represents a certain county/area in Taiwan, each center is asked to also develop materials that are particular to the local cultures and places of interests. The manpower of each resource center is drawn mainly from the schools tagged as the regional resource centers; however, some teachers from other schools are also invited to join the project. The local (county) school boards, in support of this project, offered matching funds and reduced teaching loads for those teachers who were actively involved.

The Computer Center of National Taiwan Normal University is selected as the headquarter of the NERC. It is delegated by MOE to oversee the development process of each regional resource center. Monthly meetings attended by representatives from all the resource centers have been held at the national center to exchange ideas and to review progresses. The national center is also responsible for setting up the official NERC web site, defining functional requirements, and establishing technical guidelines for all the regional resource centers to follow. The national center has also planned to offer training classes to the technical personnel and the teachers responsible for developing teaching resources. The instructional resources developed and collected by each regional resource center are placed in the NERC web site for easy access and are continuously being updated.

Content Structure of the Educational Resources

The regional resource centers of NERC are responsible for providing the educational resources, where the categorization and indexing of the contents for easy retrieval are the responsibilities of the national center. The following is a description of the available resources in each subject area and the categorization and indexing mechanisms of the contents.

The Resources

The web site implemented by each regional center was required to include at least the following components. The functions to be served by each component, as described below, were mandated by the national center. However, the style for realizing each component is left at each center's discretion based on the characteristics of the specific subject area assigned.

1 ()*Instructional Materials:* These include suggested learning activities, teaching strategies, supplemental teaching materials and performance assessment strategies.

2 ()*Test Banks:* Various types of tests, such as true-false questions, multiple choices, fill-in-the-blanks and open ended questions, are to be made available for downloading. Answers to all test questions, as well as diagnosis of learning problem associated with some of the questions, should also be provided.

3 ()*Instructional Software Collections:* Information about CAI software, including subject area, suitable grade usage, and purchasing information is to be collected for references. Free CAI software, namely those developed under MOE's funding, or other software legally licensed to be distributed are placed on-line for teachers to download.

4 ()*Discussion Forum:* The discussion forum is to provide teachers of each subject area a place to share their opinions and experiences in using the resources and to exchange instructional techniques. Furthermore, comments on further instructional resource needs can be discussed in the forum.

5 ()*Bulletin Boards:* Each subject area has its own bulletin board. It is used mainly for announcing subject-related activities such as seminars, training classes and newly available resources.
6 ()*Related Resource Links:* Subject and instructional related web sites should be collected and linked.
7 ()*Local Cultures and Places of Interests:* Each school should build web pages for local culture related materials. These include introduction to local places of interests (e.g. historic temples), special events (e.g. events during Confucius birthday), and the lifestyle of the locals.

Categorization and Indexing Mechanisms

All the available resources are grouped by the K-9 subject areas. Furthermore, the instructional materials are indexed further by the curriculum guidelines of the subjects. Thus, subject related resources could be searched in three different ways. The resources can be searched by "content providers" if one is interested in knowing what resources are available at a particular regional resource center. The contents can be searched by subject category if one is interested in finding resources for a particular subject area. Or if resources for a specific part of a curriculum are desired, then searching by subject curriculum guide is most appropriate. There is also a full-text search function for performing keyword search. As for the contents on *local cultures,* they are categorized by content providers and by the counties that they belong.

Technical Issues

Currently the resources are housed on a Sun Enterprise E450 server with Sun Solaris 2.6 operating system. The Netscape SuiteSpot server and the Sybase adaptive SQL Server have been installed to provide Center's Web and database services. In addition, Email, Ftp, and News servers are installed so that personnel of all the Centers have a common place for exchanging ideas and sharing experiences.

For compatibility reasons, the national center also defined some common frameworks that each regional center is to follow when developing resources. Among others are guidelines for acceptable audio/video file formats, CGI programming languages, frame usage, and screen resolution. More importantly, all contents are required to be viewable with both Netscape Communicator and Internet Explore web browsers.

At the current stage, most of the regional resource centers are connected to the TANet through leased dedicated 64K lines. Only handfuls have T-1 lines. The national center, being situated at the MOE, has direct access to the TANet. Thus, to provide better response time for the users, currently the regional centers are required to upload their resources to the national center, so that request to access any of the resources in NERC can be quickly fulfilled. In the future, it is planned that when all the regional resource centers' Internet connection speeds are upgraded to reasonable levels, then the Homepage at the national center will act only as a portal gateway to all the regional centers, providing hyperlinks to the contents available in each regional resource center. The resources of the regional centers will no longer need to be uploaded. Instead, they are left in the regional centers; thus, allowing more freedom in the organization of the resources.

Some Experiences

After having been engaged in the start up process of the NERC over the past year, we have had many valuable experiences to share. Following are some of them in brief statements.

8 ()Even with frequent meetings and e-mail correspondence, some regional resource centers failed to follow the guidelines set by the national center. A rewarding system, in terms of more funding, might be placed to entice closer guideline following.
9 ()In spite of the repeated reminding that the resources should be targeted at teachers rather than students, some regional resource centers still seemed to be confused about its purpose. An instructional resource development training course is scheduled to give all teachers a better perspective of what is expected.

10 ()Some schools, which were assigned with the same subject areas, ended up with similar contents. A better division and assignment strategy of the subject areas is needed.

11 ()The resources provided by each regional center were mostly textual information and still pictures. Multimedia materials including sounds, animations and videos need to be further encourages, perhaps through the scheduled training courses.

12 ()Teachers involved in the development of the instructional materials sometimes lose sight of focus and are trying to show off their technical abilities rather than concentrating on the instructional contents. Again, the instruction resource development training course can be used to stress the importance of contents over fancy presentation techniques.

13 ()So far, only an informal evaluation of the instructional contents has been done. A set of evaluation criteria and scales is to be developed so that formal evaluations can be carried out. Quality of the contents can then be better measured.

Concluding Remarks

Within the past year, MOE had spent over two million U.S. dollars in the initial setup of the NERC. Half of this fund was used toward hardware's setup of each regional resource center, such as audio/video equipments and web servers. The other half of the fund was spent on the development of K-9 educational resources. In this coming year, MOE has allocated approximately five million U.S. dollars for continuing growth of the educational resources. Thirty-nine regional resource centers are to be added this year, including seven for providing K-9 educational resources and 32 for providing 10-12 educational resources. It is hoped that by year 2000, NERC will have enough useful resources for teachers in all subject areas to use in the classrooms. In the future, teachers at all levels will be welcomed to submit teaching resources of their creation to enrich the collections of the NERC. It is the goal of the NERC to see voluntary involvement of the teachers, both as beneficiary and resource providers.

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Exploring the Establishment of Statewide Distance Policies in Georgia

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Abstract: A Georgia Statewide Academic and Medical Systems (GSAMS) grant was awarded jointly to the State University of West Georgia and the Georgia Merit System to explore the distance policies of various types of institutions in the state during the 1998-99 academic year. Two major areas of concern were explored: (1) how distance policies were established, and (2) what policies have been established. Five policy areas were examined: administration and management issues, technical issues, pedagogical issues, training issues, and evaluation issues. This paper presents the procedures used by the team to design and conduct the study, a description of how data will be analyzed and future directions of this research.

Introduction

The Georgia Statewide Academic and Medical Systems (GSAMS) is a two-way video-conferencing program that is the largest distance learning and healthcare network in the world, with more than 370 + sites as of December 1998. Included in the GSAMS network are K-12 public schools, colleges, universities, technical institutes, hospitals, prisons, Georgia Public Television, and Zoo Atlanta. As the number of GSAMS sites throughout the state have increased the past three years, the need for more consistent policies across the system in a variety of areas has become increasingly apparent. There is great variance in the state with regard to: site charges; how a wide variety of technical problems which have arisen are handled; how sites are managed; procedures for training distance personnel; and evaluative efforts that are taking place to assess the impact, strengths, and weaknesses of the GSAMS system.

To date no statewide study has been conducted to examine the existing policies and the formal/ informal procedures that are in place in the state. Lacking this, there is currently little formal information available for consideration of the policies, procedures, and effectiveness of the GSAMS effort. This information is vital in order to identify what current policies, procedures, and evaluation measures are in place and what should be done to make across the system recommendations for improvements in GSAMS policies which can then be adopted by institutions and agencies in the state.

The Research, Media, and Technology Department at the State University of West Georgia (UWG) and the Georgia Merit System (GMS) jointly received a state Georgia Statewide Academic and Medical Systems (GSAMS) grant to examine the current distance education policies in the state. Both organizations were charged with collaboratively conducting research to look into the process and outcomes of policy-related decisions and discussions in areas that impacted GSAMS utilization and operations. Five

areas of policy-related concerns were explored: (1) the administration and management of distance systems, (2) technical issues related to GSAMS, (3) pedagogical issues, (4) distance training issues, and (5) evaluation issues.

Methodology

Participants

In November 1998 all GSAMS sites in Georgia, except the telemedicine sites, were surveyed. Each site received two surveys. The site coordinator was instructed to complete one survey and distribute the other survey to an experienced distance instructor.

Procedure

The two institutions utilized the GSAMS system, e-mail, videotapes, and fax to plan and carry out the study. The following procedures were followed.

1. GMS and UWG selected a research team and scheduled planning meetings via GSAMS to make decisions on a number of factors such as the division of the grant money, responsibilities for each team, the nature of the survey, project timelines, and disseminating the results. GSM agreed to arrange and conduct the focus group sessions, develop a typology of GSAMS users, identify all of the current GSAMS sites in the state, assist with the fine tuning of the survey, and mail the to the respondents. UWG agreed to provide the leadership in designing the survey, collecting and analyzing the data, posting the findings on the RMT department's webpage and disseminating the results to interested distance professionals.
2. GMS conducted three focus group sessions during the month of August. GSAMS users from the various settings were sent letters inviting them to attend a focus group session. The intent of each session was to generate data from the diverse users on the various distance policy issues and procedures that existed in the state and identify some of the growing and continuing concerns. Each session was videotaped and conducted from a GSAMS room so the UWG research team could be connected and participate in the session.
3. During September the UWG research team transcribed notes from videotapes and observations of the focus group sessions and then designed the survey based on the generated data. In addition, the research team utilized their personal observations of GSAMS sessions, discussions with distance experts in the state, and a review of the distance literature to construct the GSAMS survey.
4. The survey was reviewed, fine tuned, and pilot tested during October. The appropriateness of the questions, multiple choices provided to the questions, length and format of the survey, and how the respondents would respond to the survey were closely examined. After extensive discussions the team decided to provide two options for respondents to answer the survey. They could choose to write their responses on the survey and mail the results or electronically respond to the survey on the RMT department's homepage.
5. In November two surveys along with a letter, explaining the state-wide GSAMS study, were mailed to all GSAMS sites in the state, except for the telemedicine sites. This consisted of approximately 380 sites.
6. During December and January the surveys will be collected at UWG. Research experts in the department will then enter and analyze the data.
7. The findings will be posted on the RMT department's webpage in March 1999 for interested distance personnel to access.

GSAMS Policies and Procedures Questionnaire

The survey consisted of both closed and open-ended questions. Questions 1-61 utilized closed-ended questions where respondents were asked to select and circle all responses, from a multiple listing of choices, that applied. Questions 62-67 were open-ended questions.

Demographic Questions (N=5):

1. What is your organizational setting?
2. Who is your primary GSAMS target audience?
3. What is your purpose of programming?
4. What is your primary geographical distribution of programming?
5. How many years have you been in operation with GSAMS?

Administration/ Management Questions (N=11):

6. Do you have written GSAMS administration and/or management procedures in place at your institution?
7. Who does your GSAMS unit in your organization report to?
8. Who makes budget decisions for your GSAMS site?
9. What type of assistance is provided to distance instructors?
10. What percent of workload time is your GSAMS director/coordinator given credit for coordinating the
11. Who manages the scheduling of GSAMS classes/ sessions?
12. Do you charge for the use of your GSAMS facility for outside users?
13. If you charge for outside personnel to use your GSAMS site how much do you charge for the room
14. Do you charge for the use of a facilitator for outside users?
15. When outside users use your GSAMS room do you require your site facilitator to be used?
16. When is your GSAMS programming going out or being received?

Teaching Questions (N=12):

17. Do you have written GSAMS teaching policies in place at your institution?
18. What methods do you use to select distance instructors?
19. What criteria are used to select distance instructors?
20. Are distance instructors at your institution given some kind of incentive for teaching via GSAMS?
21. What type of incentive is provided to instructors at your institution?
22. Are instructors provided with assistance when delivering a GSAMS session/class
23. What type of assistance is provided to distance instructors?
24. Does your instructor and/or institution provide any student orientation to GSAMS (to introduce procedures for learning at a distance including roles and responsibilities of teachers and learners)?
25. What type(s) of student orientation is/are provided to distance students?
26. Do instructors make any attempt to provide feedback or to establish communication with learners outside of the distance learning situation?
27. What type of communication is made with learners outside of the distance learning class?
28. What types of teaching strategies are predominantly used in distance learning classes?

Training Questions (N=14):

29. Do you have procedures in place at your institution to train individuals to use GSAMS?
30. Who is responsible for coordinating the GSAMS training program in your institution?
31. Who delivers the GSAMS training?
32. Where is GSAMS training taken?
33. Who receives GSAMS training at your institution?
34. Is the distance training required for instructors?
35. Is the training required for facilitators?
36. Is the training required for students?
37. When is the training provided for distance instructors?
38. How is training provided for distance instructors?
39. How are GSAMS training needs identified?
40. What is included in instructor GSAMS training?
41. What kind of resources and learning activities are included in locally developed training programs?
42. When did the GSAMS training program begin at your institution?

Technical Questions (N=8):

43. Do you have written technical policies in place at your institution?
44. Do you have a full-time or part-time person to take care of your equipment technical problems?
45. Who serves as your institution's primary technical support for GSAMS?
46. Do you expect your distance delivery instructors to troubleshoot in case equipment problems
47. Is your GSAMS equipment updated periodically?
48. How often is your equipment updated?
49. Do you have an equipment operation procedure manual for your distance delivery instructors or facilitators?
50. What type of room is used for your GSAMS site?

Evaluation Questions (N=11):

51. Do you have an evaluation plan in place for your GSAMS program?
52. Who/ what in the GSAMS program is evaluated at your institution?
53. What does the Distance Coordinator/ Director at your institution evaluate?
54. What does the distance instructor evaluate?
55. What does the distance student evaluate?
56. How is the distance coordinator/director evaluated?
57. How is the distance instructor evaluated?
58. How is the effectiveness of the GSAMS class/session evaluated?
59. How is the instructor-training program evaluated?
60. How often is the overall GSAMS program evaluated?
61. How are the evaluative data used that are generated from your institution?

Open-Ended Questions (N=5):

62. What have been your greatest administrative challenges with GSAMS?
63. What have distance instructors found to be the most difficult when teaching with GSAMS?
64. What problems have been connected with training programs? How did you resolve them?
65. In the past two years, what have been the greatest technical problems you have you experienced with GSAMS?
66. What are your greatest needs in evaluation including student, program, instruction evaluations?

Data Analysis

Information from the surveys will be used to calculate descriptive statistics in these five areas: administration/ management of GSAMS sites (11) , teaching via GSAMS (12), training teachers and students to use GSAMS (14) , GSAMS technical support (8), and evaluation of GSAMS courses (11). Using SPSS 8.0, Cronbach's reliability will be calculated for these five scales. In addition, chi-square tests will be used to determine whether the frequencies reported in these five areas vary by type of organizational setting, purpose of programming, and the number of years in operation with GSAMS. Open-ended questions from the survey will be examined to describe the respondents' greatest administrative challenges with GSAMS, teaching difficulties related to GSAMS, and GSAMS site needs in the areas of training, technical support, and evaluation.

Conclusion and Future Directions

The process used by the team will establish a base upon which future research on organizational development strategies in GSAMS will be built and that will maximize the use and effectiveness of distance technologies.

Acknowledgements

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Troubleshooting In The Classroom

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Abstract: Waiting days or weeks for a technician to come to your classroom to repair your computer is not only an inconvenience for the teacher but a disappointment for the students. There are basic and simple troubleshooting techniques that can be preformed in the classroom by the teacher that take only minuets. Learning these techniques will help relieve some of the headaches caused by down computers.

Teacher Technology Competencies: Early Indicators and Benchmarks

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Abstract:

Two recent trends in education — increased technology and accountability — are driving recent efforts to define technology competencies and standards for teachers. The very first lists of competencies from these efforts are just now being completed. While some of these competencies are being linked to teacher certification and re-certification, others are developed as standards or benchmarks to guide professional development. The purpose of this study was to examine and compare initial attempts at establishing teacher technology competencies with the intent of establishing a framework or matrix that could be used to compare other, similar documents. Teacher technology competencies from a variety of organizations and institutions were studied and compared. A master matrix of technology competencies was created and based on our findings generalizations are drawn and recommendations are made for improving future technology competencies. Also included is a discussion of the implications for teacher education programs, and the need to use teacher technology competencies in an integrated effort which considers not only technology but pedagogy and curricular content as well.

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Acknowledgements

Special thanks to the North Central Regional Educational Laboratory and the Department of Defense Education Agency for financial assistance with this project.

Introduction

Over the last several years a variety of projects have attempted to define technology standards or competencies for K-12 students. In 1996, the National Study for School Evaluation (NSSE) released a 140 page document entitled "Technology: Indicators of Quality Information Technology Systems In K-12 Schools" that encouraged schools and districts to develop technology standards for their students and provided examples of what such standards might entail. More recently, the International Society for Technology in Education (in conjunction with 11 other professional organizations) developed a set of student standards entitled "Technology Foundation Standards for Students" (ISTEa 1998) as part if its National Educational Technology Standards Project (NETS) which described very specific technology standards for students. These performance indicators were broken into four grade bands and five domains (recently, those five domains have been expanded into six). In the summer of 1998, the American Library Association released standards for information literacy for all students (ALA 1998).

In order for students to be able to reach these standards, technology must not only be available, but must be utilized in the classroom. Students aren't the only ones who need to be prepared for the information age — teachers must also develop new skills and competencies in order to help their students meet the challenge of the next century. Espinosa and Chen discovered that in-service teachers recognized the need for computer literacy training. This need arose from the expectation that students must obtain computer literacy from schools. Teachers play a vital role in the student development; therefore, students cannot emerge from schools computer literate if teachers are not computer literate (Espinosa & Chen 1996). However, most currently practicing teachers are not products of the computer age, and despite best attempts, even new teachers coming out of the nation's universities and colleges are not as technologically prepared as they need to be. A recent article in *Electronic Learning* addressed the fact that many schools of education have a long way to go before they are able to adequately train teachers to use technology efficiently and effectively in their classroom instruction (Barksdale 1996).

While the increased use of technology is one trend in education today, accountability is another. Calls for increased accountability of teachers and schools – return on investment - are pressuring the educational community to

define curricular standards, create performance-based assessments, and develop new ways of evaluating teachers and students. In an effort to increase accountability several states have implemented accountability indicators. It is not surprising that professional organizations, state education agencies, and school districts around the country are now beginning to examine and define skills, performances, and competencies for their teachers in a variety of areas, including technology. The very first lists of competencies from these efforts are just now being completed. While some of these competencies are being linked to teacher certification and re-certification, others are developed as standards or benchmarks to guide professional development.

Purpose

The purpose of this study was to examine and compare these initial attempts at establishing teacher technology competencies with the intent of establishing a framework or matrix that could be used to compare other, similar documents. This study took place in the summer of 1998. True to the evolving nature of the teacher technology competency movement, at the time of this writing several other similar documents have been written or drafted which were unavailable to us at the time of the study.

Process

We began the process of comparison by identifying potential sources of teacher technology standards or competencies. Such documents are being developed by a variety of organizations, including professional educational organizations, non-profit education support organizations, educational reform organizations, state education agencies, and local school districts. The International Society for Technology in Education (ISTE) document "ISTE Recommended Foundations in Technology for All Teachers" is used by many organizations as the base from which competencies are established. In general, the farther removed an organization is from the classroom, the more general and broad its recommendations tend to be, allowing room for local organizations to define and develop standards most appropriate for that community. We wanted to identify a useful variety of documents to analyze, but recognized that the organizations needed to originate from roughly the same position in the educational system. Therefore, in addition to documents developed by ISTE (a professional organization), we also sought out documents developed by state education agencies and national organizations with interests in educational technology. Additionally, we limited our study to those competencies that were not specific to any particular curricular area or grade band. We certainly recognize that there may well be differences between what a high school science teacher and a 3 rd grade teacher may need to know in regards to technology. Despite this recognition, the scope of this study focused only on those technology competencies that apply to all teachers.

State agency documents were located through a web search of those states generally regarded as leaders in the use of technology. Calls were made to agencies whose web sites indicated that student competencies had been developed and/or whose technology plans recommended that teacher technology competencies or standards be developed. Many states are in the process of developing teacher technology competencies but few have yet to complete this process. Four states' competencies were selected for inclusion in this report. While several school districts have developed teacher technology standards, none were included in this report, as they tend to be very specific and locally oriented. Documents that addressed standards for students instead of teachers, did not address technology use as a major feature, or were organized in such a way that competencies resulting from the statements given would have to be largely inferred or assumed were not included in our analysis. The following documents were included in this study:

- ISTE Recommended Foundations in Technology for All Teachers (ISTEb 1998)
- North Carolina Technology Assessment Project (North Carolina School Board of Education (1995)
- NCRTEC Portfolio: Training and Professional Development – curricular strands (draft) (NCRTEC 1997)
- Professional Development Continuum (draft) Milken Family Foundation (Milken 1998)
- Technology Standards for Instructional Personnel Virginia (Virginia Department of Education 1998)
- Instructional Technology Standards Mississippi (Mississippi Department of Education 1995)
- ABE Teacher Competencies for Technology (draft) Massachusetts (Massachusetts Depar tment of Education 1997)
- Professional development plan for teacher competency in technology (draft) DoDEA (Department of Defense Education Agency 1998).

Once the representative set of competency and standard documents were identified, they were photocopied on different colored paper, cut apart, grouped together by similarity, and assigned category names. After the competencies were organized and categorized, phrases representing competencies were written in an attempt to capture the variety of competencies and skills represented by the individual statements from the various organizations. In some cases, this meant combining several statements into one, in other cases we split large, complex statements into smaller,

more discreet units. A master list of competencies was drafted, placed into a matrix and reviewed. A close examination of the matrix revealed a few competencies that are not covered by any of the organizations examined. While it could be argued that many of the broad competencies infer these skills, the detail to which some of the competency lists are stated encouraged us to add skills where some were missing. We added these competencies after reviewing the entire list. Through our experience working with both in-service and pre-service teachers, these are skills or competencies that we feel are needed in addition to the others listed, and were thus incorporated into the master matrix. Since the ISTE standards (ISTEb 1998) are used by many organizations as a starting point for the development of their standards, we "tested" the list by comparing the ISTE standards to it to make sure they were all represented. Finally, competencies of the various organizations were entered into the matrix and a master matrix was developed which allowed comparisons between competency lists to be made.

Not surprisingly, it is difficult to develop statements that adequately reflect competencies and standards that were developed using a wide range of organizational structures, as well as for different purposes and audiences. At times, we had to infer the intent of some statements. Subsequently, replications of this process might yield somewhat different results. In spite of this, however, this comparison represents a first attempt at understanding the variety and breadth of teacher technology competencies in their infancy. As other competencies are developed, this matrix can be used to compare and contrast them to what currently exists, as well as identify weaknesses or holes in competency sets. As technology and our understanding of its power to transform what it means to teach and to learn change, this matrix can be updated and revised to reflect these new understandings.

Findings

Four major categories emerged from our analysis: Prerequisite Technical Skills, Tech nical Skills, Instructional Uses, and Professional Roles. Each of these categories contained groups of related competencies and was also subsequently given labels. All categories contained two or more subcategories, and one subcategory in the Technical Skills category was broken down into several sub-subcategories.

Prerequisite Technical Skills are skills that are so basic in nature (e.g. correctly turn on and shut down a computer) that they must be mastered before any other skills or instructional applications can be learned. Technical Skills are skills that are hardware/software based. These "how to" skills underlie all use of computer and related technologies.

Instructional Use competencies are those which focus on applications of technology in classroom instruction and student learning. The development of Technical Skills and Instructional Use competencies will most often happen concurrently. One competency set does not necessarily precede the other; rather teachers best learn them in conjunction. In fact, research shows that teachers react negatively to those courses that just emphasize technical skills without regard to teacher practice and teaching (OTA 1995) (p 137).

Complementing all competencies are those associated with teachers' Professional Roles. These competencies reflect those activities and behaviors which teachers must engage in an information age classroom. These behaviors and competencies are essential for all teachers regardless of their proficiency in using technology in the classroom. The competency categories and subcategories are listed below (Tab. 1):

Competency Categories	
Prerequisite Technical Skills Basic Operations Hardware Issues Navigation File Management **Instructional Uses** Instructional Strategies Instructional Resources **Professional Roles** Ethical and Legal Issues Professional Resources Professional Development	**Technical Skills** Basic Technical Skills Advanced Technical Skills Troubleshooting and Maintenance Adv. Troubleshooting & Maintenance Productivity Tools Word Processing Database Spreadsheet Graphics Multimedia Advanced Multimedia Advanced Productivity Tools Internet Applications Adv. Internet Applications Networking Advanced Networking

Table 1: Competency Categories and Subcategories

Several characteristics of this list of competency categories are immediately apparent. First, there are considerably more subcategories in the Technical Skills category than in the other three. We imagine that this reflects the tendency to focus on hardware and software skills rather than instructional integration skills. On the other hand the large number of subcategories illustrates both the array of technology opportunities available to teachers as well the breadth of competencies in technical skills that teachers must develop. Second, in some instances, organizations had broken some of the technical skills into basic and advanced. For example, Productivity Tools, Internet Applications, and Networking all had advanced competencies listed. Finally, only the Prerequisite Technical Skills category is entirely prerequisite to all others. The remaining can be learned in any order (or concurrently) depending on the specific instructional application and time available to learn the hardware, software, and instructional or professional application.

The diagram below (Fig. 1) illustrates our initial view of the interrelationships between these competency categories. Notice that the Prerequisite Technical Skills category underlies and is prerequisites to all other competency categories. Each of the other categories, Instructional Use, Technical Skills, and Professional Role categories can be developed independently and concurrently. Often times increased competency in one category leads to increased competency in others.

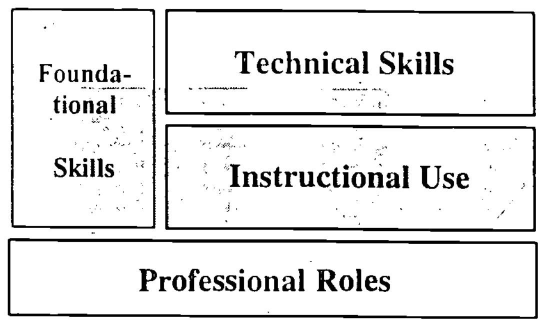

Figure 1: Major Categories of Teacher Technology Competencies

In general, teacher technology competencies appear to cover a wide range of skills and instructional applications. A review of the predominant institutions developing competencies revealed the following biases:

- ISTE, Virginia, and Mississippi covered the general scope of competencies with broad sweeping statements. Although the competency areas were addressed, the detail necessary to add value was lacking, leaving many questions unanswered.
- North Carolina competencies emphasized evaluation of skills (not surprising considering this document is guiding evaluation and certification of teachers). Therefore, their document was extremely detailed in the technical skill competencies.
- Massachusetts appears to be very technical skill based; however, the section covering multimedia skills seems fairly weak. Massachusetts's competencies failed to address both instructional and professional skill areas.
- Only one document (Milken) organized its competencies around stages of teacher change, listing different performances or behaviors that teachers would engage in at different points in their own development. While this orientation provided challenges to finding fit with other competencies, we found it to be very well thought out and potentially the most useful for identifying professional development needs. Two other documents (North Carolina and Massachusetts) included advanced levels of skill and performance but were not tied to teacher development or change theory.

Implications

We believe that it is a strength to allow schools to define, based on the learning needs of their students, what each of these competencies mean. That is, depending on the curricular goals that they are trying to achieve through technology, schools will identify particular applications and the necessary skills that teachers must possess in order to use those applications. It must be stressed that the purpose of these competencies is to ensure that all teachers can use technology appropriately to support learning; achieving the competencies is a means to an end and not an end in itself. The more specific competencies presented in the master matrix might be used by schools to guide the development of workshops and support materials to ensure that all teachers have the opportunity to develop particular skills that are most appropriate.

We strongly encourage schools to focus on the vision of learning that they are developing these competencies to support. Professional development activities that teach technical skills should always do so in the context of designing a lesson, creating curricula, or solving an instructional problem.

In addition, assessment of teacher competence with technology should be authentic and i ndicate whether the competencies teachers possess are adequate to support the vision of learning in actual classroom settings. We recommend that schools closely examine documents that provide deeper guidance about improving curriculum, instruction, and assessment with technology. *Plugging In*, by NCREL (Jones et. al. 1995), and the Milken Technology Professional Development Continuum (Milken 1998) both present indicators of technology supported engaged learning that can be used to expand a vision of learning and guide the appropriate integration of technology.

The establishment of technology competencies for teachers have has special implications for teacher education programs. As stated earlier, requiring students to have technology competencies will also require teachers to have technology competencies. Over the course of the last decade technology has been gaining more importance in teacher education programs but most programs still have a way to go before they can adequately prepare their graduates to use technology to its fullest potential in their teaching and administrative activities (Barksdale 1996).

Many teacher education programs have begun to offer classes that instruct students on techniques for using technology. However, in order to fully prepare teachers to teach with technology, teacher education program staff must demonstrate proper use of technology for teaching in their own instruction. It would seem that the need for technology competencies has worked its way from the bottom up. The need for technology competencies for students has inspired the need for technology competencies for teachers, and we feel that this in turn should indicate the need for technology competencies among those staff members who are training students to become teachers.

A final consideration is to make sure that technology is used to help students meet content standards. Technology skills for students are important but the thrust must be on learning and understanding content. Thus an emphasis must be placed on using technology to help students achieve the most difficult to learn, yet critical concepts. To do so teachers must possess an adequate grasp of the content. While the technology staff development curriculum can and should address competencies in both technology and pedagogy, the basis for increasing competence in the content areas must come from content-specific curriculum staff development activities. It is crucial, therefore, to integrate technology, pedagogy, and content staff development activities into a single, coherent effort (Fig. 2).

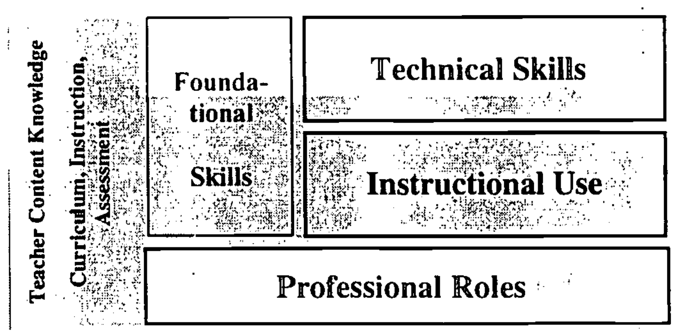

Figure 2: Interrelationships of Teacher Content Knowledge, Pedagogy, & Teacher Technology Competencies

The fundamental competency areas needed to be possessed by teachers if they are to use technology to engage students and to help them learn meaningful content is shown in the diagram above. Notice that there are three foundational competency domains that teachers must possess: Pedagogy (curriculum, assessment, and instruction), Prerequisite Technical, and Content Knowledge. From these domains teachers refine and develop skills and knowledge in the application of technology to support learning in content areas. The development of technology competencies should always be viewed in the context of this interrelated system of knowledge, skills, and experience.

Stumbling Blocks and Stepping-Stones: Keys to Successful Video Conferencing Networks

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Introduction

Current technologies have overcome two of the major restrictions that have constrained educators throughout history. Time and space have always limited individuals seeking to impart knowledge. Instruction has been delivered at a definite time and in a specific location thereby restricting access to those who could be at a specific site at a specific time. With the convergence of several technologies, today we can make education accessible outside these traditional boundaries. The educational environment itself is changing from a bricks and mortar concept to one of extended telecommunication networks employed to exchange information and resources across time and space.

Major Challenges

Collaboration Not Just Cooperation

Distance learning networks require true collaboration. In the past entities have often cooperated with each other. Cooperative agreements meant dividing responsibilities and sharing costs and resources. In cooperation people often meet, decide who will do what and depart to do their individual assignments. They do not feel responsible for the success of others and feel they have done their job when their specific tasks are completed. In collaboration there is a feeling of responsibility of all for the success of the whole. Collaboration is often characterized by a blurring of roles, exchange of duties, constant communication, and a willingness to do whatever is needed for success.

Technology Itself

The complexities of convergent technologies used in distance education make reliability a significant issue. There is end use equipment such as cameras, monitors, computers, and VCRs all with electrical and electronic connections within the room. These are controlled either by software or a switching system. These items all separately and as a system are plagued by the usual "mechanical difficulties" that are normally encountered with technology. In addition, the connectivity of the system takes the signals through a campus network or telecommunication systems and out over phone lines or microwave signals. Lines may run through several phone companies, multiple switching devices and countless miles that offer potential difficulties all along the way. Then transmission goes though another campus system of connections and finally into another set of site equipment. All of these things must work independently and together to deliver distance learning. When there are problems, isolating the cause and locating the problem is a major task. Often problems take what seems to be an inordinate time to resolve because the location of the problem

cannot be pinpointed. Fixing the problem is often relatively easy but tracing the source of the problem may be of major consequence.

In addition to the complexity of the technology itself the system involves many vendors and areas of responsibility. It is often hard to define responsibility for the performance of one piece of equipment when its performance is dependent on several others. Vendors tend to point fingers at pieces of equipment they did not provide as the source of trouble. In areas of connectivity when a line is not functioning properly, a major effort may be required to discover if the problem is within the demark on campus versus a line problem that is the responsibility of the carrier.

Dealing With the Concept of Change

> "There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain of its success than to take the lead in the introduction of a new order of things."
>
> Niccolo Machiavelli

Humans resist change. In fact, many people are drawn to the traditional stability of higher education because they are more comfortable in an environment that changes slowly. In institutions of higher education teaching methodology is still heavily dominated by the lecture mode even though in business and in public school classrooms newer methods have replaced the traditional delivery of instruction.

The infrastructures of policies, people, and budgets necessary to support distance learning do not already exist. Problems occur that no one ever encountered before. Creative solutions rather than a reliance on established procedure are demanded. The old saying "we make the road by walking on it" applies to distance learning. Leaders in the area of distance learning have to also accept the challenges of being a change agent within the school or university

Visibility

Distance teaching represents a technology based innovation that frightens many educators. A distance educator is more visible. No longer can they shut the door and create an isolated kingdom within four walls. There is a certain risk in delivering through a network to distant places that make instructors who are less than confident in their delivery refrain from teaching in a distance environment.

Control

In a distance environment there are some things that are traditionally controlled by the instructor that are in the control of others. Technology difficulties effect the delivery of instruction but occur no matter how carefully plans are executed. The distant classroom may be hot, cold, stuffy and poorly arranged and there is nothing the instructor can do. Many times they may not even be aware of problems at the distant site that effect the students' attention or their involvement in the class.

Roles

Distance learning calls for new roles and new skills. The teacher must attain a certain level of technology competence to be successful. This requires training and access to hardware and software that support materials and presentation in the distance classroom. Universities must assign staff to assist in developing materials, train instructors and provide technology support for distance learning. Budgets must be realigned to cover equipment, personnel and other associated costs. Often projects begin as a result of a grant, leaving problems of financial sustainability after the original grant period is over.

Reward Structures

An area that is extremely slow to change is that of university reward structures. It is often difficult to determine course load equivalents for classes delivered at a distance. Getting departments and colleges to reward and respect the additional effort of interactive teaching is difficult. Promotion and tenure committees are slow to recognize the incorporation and use of educational technology as legitimate teaching accomplishments. Writing multimedia material or developing web pages in support of distance activities are not considered academic activities. This often has the effect of limiting instructors interested in distance learning to those who have tenure and advanced academic standing.

Other conflicts involve the concept of what is good practice in distance education. Since most networks are relatively new entities, instructors and participants alike have expectations for distance learning that may or may not be realistic. There is often a mistaken belief that we should do something just because the technology is capable of it. Dedication to maintaining a student centered outlook and making decisions based on content and learning may become overshadowed by the temptation to showcase the technology itself.

Solutions

True Collaboration

Relationships based on trust are necessary to successful networks. By their very nature networks are extremely interdependent. Decisions made by one entity effect the operation of the whole. The participants must have working relationship that is supportive and not into a "gotcha" mentality. Policy should be developed by a cross section of people who are involved in the collaborative in different roles. Constant communication is a must to prevent small problems from becoming big ones. Since the people involved are separated by distance and work for different entities, communication takes more constant effort. Regular communication channels must be established that insure the flow of information and ideas though paper, electronic messages, and face to face meetings.

In order to create a network that is reliable and operates effectively, planning should receive the utmost attention. A pilot that allows the participants to test technologies and connections over time is an excellent way to avoid large-scale problems. Never buy equipment that you have not seen in use. Talk to people who own like equipment. Never be the guinea pig or the first. Ask how many installations your vendor has completed and if possible speak with some of their customers. You do not want a vendor or installer who has just acquired the new product. It is also advisable not to piecemeal your purchases. Even if

you save a few dollars on one component of the system you will end up with a system that no one vendor feels responsible for. Make sure the company you choose will be around when you need them. This is particularly difficult in technology because so many new companies are in business. Maintenance contracts are the best solution for many users who do not have trained technical support within their organization.

Promoting and supporting change is always difficult. Providing non-threatening training and support for instructors is a must. Allow people to make incremental change. Encourage first efforts and allow time for the process of change to take place. Instructors are likely to be overwhelmed by a wholesale change of setting, materials, technologies and teaching strategies. One good idea is to create one or two classrooms with all of the technology, (monitors, computers, cameras, and visual presenter) that are not connected to the outside world. This allows instructors to get used to a multimedia classroom before they deal with the idea of distance teaching.

Strategic planning processes that tie the mission of the organization to expenditures are the best way to integrate distance learning into the policies and budget. If distance learning is reflected in long range planning and supported by top administration the changes necessary at the departmental level are easier to facilitate. Reward structures that respect the effort involved to teach at a distance and prepare quality materials should be recognized as a vital part of the teaching role. Support through priorities for faculty development leave, grants for professional development, and the distribution of technology funds can actively support distance learning without additional funds.

Distance educators must continually seek to define best practice. The pedagogy appropriate to this delivery system is still emerging. It is exciting and stimulating to realize that the technology makes things possible that were not possible before. The technology overcomes many restrictions that educators had to consider in the past. Although distance learning represents many challenges for the faculty and administrator involved, this use of technology holds many exciting promises for the future of education. The greatest promise lies in the word access – access to educational opportunities that can truly make a difference in the lives of students and communities.

Interoperability and incompatibility have been a problem in the past. Systems from one vendor might or might not connect effectively with each other. Today however, the major vendors have adopted standard protocols established by the International Telecommunications Union-Telecommunication Standardization Sector that ensure the interoperability of systems regardless of the vendor.

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Timber Lane Tales: Problem-Centered Learning and Technology Integration

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Abstract: Technology integration was probably never part of faculty learning experiences and often not part of their own elementary teaching experiences. Except in occasional and haphazard ways, technology integration was not part of preservice candidates' experience as a learner any more than it was part of faculty's experiences. Yet, teacher education promotes technology integration in the teaching/learning process is an important educational goal. This exploratory study examines a field-based project where faculty and preservice candidates collaborated to implement a problem-centered, technology integrated curriculum. Preservice candidates' reflections on their experience are compared with the reflections of preservice candidates who completed a less structured field experience.

Introduction

The art in teacher education depends on the complex interplay of theory and practice and finds its most important expression in the bridge between the two. If aliens were to visit Earth to study this art, they might well be perplexed by the many seemingly contradictory relations between faculty, preservice candidates, and elementary students. Although the object of a faculty's interest might be the learning of elementary students, their students are actually preservice candidates not elementary children. Faculty's relationship to the elementary classroom is generally dependent on their memory of their own practice or on their observations of others practicing in that environment. Learners in elementary classrooms are not faculty's students but the students or perspective students of their students. Faculty teach in university classrooms not elementary classrooms. Faculty design curriculum for perspective teachers not for elementary children. Technology integration was probably never part of faculty learning experiences and often not part of their own elementary teaching experiences. Rather, it is an innovation about which they teach, research, write, and debate.

For the preservice candidate, their role is not as teacher but as student. Their role in university classrooms is to learn about teaching; their role in schools prior to actual student teaching is to observe teaching. The elementary curriculum is something someone else has planned. Teaching is their goal not something they do. Except in occasional and haphazard ways, technology integration was not part of preservice candidates' experience as a learner any more than it was part of faculty's experience. Preservice teachers hear about technology integration. They are told how it might be done. When they are sent to schools to observe others teaching, they often see little technology use and only rarely see technology used as an integrated part of the ongoing instructional program.

The contradictory roles and relationships of faculty and preservice candidates make the bridge between theory and practice ever more problematic as "state-of-the-art" knowledge about technology integration among educational theorists moves farther and farther from most observable educational practice. How would preservice candidates' understanding of technology integration be different if faculty were to design and implement curriculum for elementary students that modeled educational practices taught during courses? How would preservice candidates' understanding of technology integration be different if what faculty and preservice candidates shared was not a university classroom but an elementary classroom?

How would preservice candidates' understanding of technology integration be different if conceptions of technology integration became realities not abstractions? The opportunity to explore these questions presented itself when the principal at Timber Lane Elementary School called.

Timber Lane Tales

Timber Lane Elementary is a small school nestled in a large metropolitan area. With a high yet stable population of low socio-economic and minority students, teachers and administrators at the school worked for two years to find instructional alternatives that would meet the unique and challenging needs of this population. Their research led them to year round schooling. After surveying the community and making appropriate arrangements with district personnel, Timber Lane Elementary School began a year round program in late summer, 1998. Part of the program was to implement innovative two-week instructional intersessions during the three-week breaks between formal instructional periods. The faculty contacted a broad range of community resources, seeking volunteers to develop and conduct non-traditional learning modules during these times.

Among those who responded to the call for innovative modules, the authors – both university professors - offered to participate. What might instruction for upper elementary students look like if it integrated technology throughout the learning process? How would young students respond to that instruction? Norton and Wiburg (1998) state that the design of instruction that integrates technology lies at the intersection of thoughtful decisions about educational goals, content, activities, and tools. Educational goals include instruction that seeks to promote literacy, problem-solving, knowledge, information use, and community. Content includes the events, concepts, and examples that reflect disciplinary knowledge and are defined by professional and state standards. Activities include those that are problem-centered, project-based, authentic, constructivist, and cooperative. Tools such as the Internet, word processors, hypermedia, and simulations should be selected to support goals, contents, and activities. Thus, a range of technologies become an integral part of the instructional design not an object of instruction. Using this model of technology integration suggested designing problem-centered units for each of the intersessions as opposed to offering workshops on hypermedia or the Internet.

A multiage (4th, 5th, and 6th grade) problem-centered, technology integrated intersession was planned and implemented. During the October intersession, elementary students were challenged to join the Timber Lane Detective Agency and refine their detecting skills such as fingerprinting, handwriting analysis, code breaking, and mystery solving. The intersession activities culminated in children's earning the badge of a "Master Detective" which authorized them to identify and arrest school personnel accused of committing offenses.

The authors designed the curriculum and instructional materials in the weeks prior to the intersession using the framework developed by Norton and Wiburg (1998). Content selected included detective skills such as fingerprinting and handwriting analysis, advertisements, and literature-based mystery stories. Educational goals focused on developing problem-solving skills, literacy abilities, and working as a community. Activities included solving mysteries, analyzing clues, writing mystery stories, creating advertisements, and investigating crimes. Tools used throughout the two-week curriculum included paper and pencil assignments, word processors, video, simulations, books, print graphic programs, computer-based interactive fiction, and databases. At the intersection of these four considerations was the design for the Timber Lane Detective Agency curriculum and the unifying central problem - can you learn to solve mysteries well enough to earn the privilege of making an arrest.

In preparation for the intersession, student handbooks were designed and desktop published on advertising a detective agency, fingerprinting, code breaking, and handwriting analysis. The handbook on advertising a detective agency asked children to analyze ads for detective agencies taken from the phone book. Their attention was drawn to selection of a name and logo for the agency, descriptions of the services provided by a detective agency, and communication of information about agents and contact information. Once students had completed the handbook, they were divided into groups of six and asked to form a detective agency and use *PrintShop Deluxe* to create an advertisement and banner for their agency. The handbooks on fingerprinting, code breaking, and handwriting analysis were interactive. Agencies collaborated on completing the learning activities associated with the handbooks. When a handbook was completed (usually over several days), the agency was given mysteries to solve that required them to use the information learned from completing the handbook.

Another component of the Timber Lane Detective Agency curriculum was the selection of two *Shelby Wu* mystery videos that students watched and solved. A word processor and *PrintShop Deluxe* were used for publications. Students also played with *Where in the USA is Carmen San Diego* (Broderbund), *Wishbringer* (Infocomm), and *Sherlock Holmes Consulting Detective* (ICON Simulation), solving the mysteries presented by these software packages. Six *Encyclopedia Brown* mysteries were selected. Worksheets were created to assist agencies to solve the mysteries. Each time students were successful at solving one of the mysteries, they earned a promotion and a new badge.

A database and a file containing digitized pictures of school personnel were created. Practice mysteries were written which required students to use the database. When students in each agency had earned a "Master Detective" badge, the agency was given a special crime to solve using the database. They then made Wanted Posters and arrest warrants using *PrintShop Deluxe*. Each agency planned and wrote a mystery. When the agency made an arrest on the last day of the intersession, the "criminal" was given the opportunity to solve the mystery written by the students to avoid being sent to jail.

Each morning when students arrived, the agencies' case assignments for the day (approximately one hour for each of three activities) were written on the board. For each case assignment, the agency was assisted in completing their assignments by one of the authors or one of the six university preservice candidates who joined the authors to teach the intersession. The preservice candidates and authors rotated among the agencies, switching groups as each new assignment began. The preservice candidates and authors had multiple opportunities to work with each agency and to teach each of the different activities. Informal conversations occurred frequently about the needs of particular students, about strategies for working with children, about the goals and activities associated with each case assignment, and the curriculum as a whole.

The Timber Lane Tales project was intended as a learning experience for educators across the developmental spectrum. For university professors, the two-week intersession format offered the opportunity to enter elementary classrooms and teach both young students and preservice candidates within a structure that could be adapted to other university commitments. It offered a "living laboratory." For preservice teachers, participating in Timber Lane Tales provided the opportunity to actively teach and observe curriculum and instruction that brought to life their studies about educational practice and offered a vision of technology integration.

Studying the Timber Lane Experience

All preservice candidates attending the Graduate School of Education at George Mason University must complete a three credit hour course focusing on educational technology. Sections of this course are tailored to the grade levels associated with the license they are seeking. Students who enroll in this course must complete a 15 clock hour field experience as part of the course requirements. A placement specialist is responsible for assigning students to a school and providing a contact person. Preservice candidates are responsible for contacting that person and arranging times to complete the field experience requirements. During their field experience time, students are asked to observe classrooms, teachers, and students who are using technology.

In preparation for the Timber Lane Tales intersession, the authors visited each of the sections of the educational technology course. The project was described, and students were offered the opportunity to substitute participation in the project for the more open-ended field experience. Since the total time commitment for the intersessions exceeded the field experience requirements by 12 hours, the software review requirement was also waived. Many of the students enrolled in the educational technology sections are employed during the day, and the extensive commitment associated with the project (from 9:00 AM to 12 PM, daily for two weeks) was not feasible. However, two men and four women volunteered. One week prior to the beginning of the intersession the preservice candidates and faculty met for a three hour period. The curriculum was described, and instructional materials were reviewed. Roles and responsibilities were discussed. All questions were answered.

At the completion of the project, preservice candidates' were asked to write their reflections to four questions: 1.) What did you learn about yourself during your two weeks at Timber Lane? 2.) What did you learn about teaching during your two weeks at Timber Lane? 3.) What did you learn about the learning/thinking process and about young learners during your two weeks at Timber Lane? And 4.) What did you learn about technology in educational settings during your two weeks at Timber Lane? To

compare the impact of the experiences of the preservice candidates who participated in the Timber Lane Tales project with the experiences of their fellow classmates who completed the field experience, six classmates were randomly selected and asked to provide the authors with their reflections to four questions. The questions included 1.) What did you learn about yourself during your field experience? 2.) What did you learn about teaching during your field experience? 3.) What did you learn about the learning/thinking process and about young learners during your field experience? And 4.) What did you learn about technology in educational settings during your field experience?

Learning about Themselves: The following represents an overview of responses with representative samples of comments. In response to the first question – what did you learn about yourself, preservice candidates who complete the field experience had little to say. One candidate simply wrote "nothing new." Another preservice candidate wrote, "What I learned about myself from these classroom visits is the value I put in personal strength, by this I mean character and personality, as the overriding determiner of success in a classroom. I did have opportunities to watch as teachers showed off their fancy equipment and skills. The success of the lesson seemed more dictated by how the class was run." A third preservice candidate stated: "I learned that I should adapt well to technology use . . . I am well organized and analytical in my approach to developing materials. I observed that these are prerequisite aptitudes for teachers that want to integrate technology into their traditional lessons."

In marked contrast, the preservice candidates that participated in the Timber Lane Tales project expressed many things they felt they had learned about themselves. Several of them talked about learning about patience. One preservice candidate discovered they were more patient than they thought while another stated they needed to learn to be more patient. Several students reported learning that they did not always have to be the expert. One preservice candidate wrote, "The most important thing I learned is that it is O.K. to not be an expert. Although I don't know much about computers, I found myself experimenting more. The kids did not seem to mind that I did not know everything." Another wrote: "Reflecting on my experience with the kids at Timber Lane, I learned that as an instructor it's okay to not know everything or every answer, because sometimes the way that a student's face looks when they can teach you something is priceless and was worth my own humility." Finally, those that participated in the Timber Lane Tales project felt positive about their interactions with children. For instance, one preservice candidate wrote: "I felt that I was able to connect with the students, not all of them all of the time, but generally I could relate to them and they to me."

Learned about Teaching: In response to the question – what did you learn about teaching, the preservice candidates who completed the field experience once again did not make expansive comments. Classroom management seemed of concern to many of them. One student wrote: "Lesson Plans and Technology cannot make up for attention that is lost due to lack of classroom control." Another stated: "The one teacher I observed who best used technology as a tool was a woman who had a strong, commanding personality which resulted in good classroom management." One student who observed students working with graphing calculators wrote: "During the 1 hour and 40 minute period the students spent doing the lab, the teacher spent about 10 minutes at the beginning visiting with each group to record the scores from their homework assignment in her grading book. She spent the rest of the time at her desk like a mother hen watching her chicks busy at work. On occasion someone would come up and ask a question. . . . She was the only teacher with whom I worked that didn't seem frazzled and exhausted at the end of the day." Another student who observed an ESL teacher wrote: "Class size makes all of the difference in the world. It is possible for students to get so much more attention in the smaller classes."

In contrast to those who completed the field experience, those who participated in the Timber Lane Tales project reported learning many things. One student wrote: "I learned that the student-teacher relationship is important, and that students will generally try to please the teacher when they feel that the teacher cares about them." Many of their comments expressed that they had learned much about the need for flexibility in teaching. For example, one preservice candidate stated: "I learned that teaching is not linear, but changes with every student. . . . you must be sure to keep lots of ideas on the back burner to use when things just don't work out and creative changes have to be made." Another wrote: "I learned that a teacher must be flexible and make modifications and accommodations when necessary, even right in the middle of things." In addition to comments about flexibility, those involved in the Timber Lane Tales recognized the importance of planning. For example, one preservice candidate reflected: "I think planning is one of the most important tools in teaching. . . . I think it is harder than it looks if you want to be good. You don't see all the preparation work involved in the lesson." Another wrote: "I learned that teaching takes a great among of preparation outside of class time, but that it pays off by making the class time more

productive." A third theme that emerged from their comments center around the recognition of varied learning needs among the students. One preservice candidate wrote: "I learned that every student has different levels of ability and a teacher needs to accommodate and teach to each one." A second preservice candidate stated: "I saw that kids do have different needs and sometimes just being flexible is all you need to solve the student's problem." A third preservice candidate reflected: "I learned that there is a wide variance in reading ability among the students and that the lack of reading ability is a handicap in a student's non-reading development. I observed a variety of learning styles and intelligences among the students and learned more about the need to recognize and teach to those styles for individual students."

Learned about Young Learners and the Learning/Thinking Process: The third question asked for reflections about what the preservice candidates' had learned about young learners and the learning/thinking process. Consistent with previous questions those who had completed the field experience provide only a few reflections. One student omitted the third question, responding only to the other three questions. One student wrote: "I learned that confidence, or lack thereof, is everything." Another stated: "Students seemed eager to learn and share when presented with opportunities which challenged and respected them. Their learning process shut down, or failed, whenever they were given work that did not do these things." A third reflected: "It seemed to me that these students were at the primary age of learning. This is the stage of life they will be taking in the greatest amount of new information in the smallest amount of time."

No trends were evident in the responses of the preservice candidates' who participated in the Timber Lane Tales project, but a number of interesting insights emerged. One preservice candidate wrote: "I really took notice of the ways in which young learners can be really bold when trying out new things." Another stated: "I learned that most of the student had not developed a logical cognitive thought process . . . . At the same time, it was possible to teach them, through example or asking questions, how to approach solving a problem." A third preservice candidate reflected: "The students enjoyed succeeding. The detective activities were successful because they asked the students to think and not to just learn (or memorize) something. But, of course, by getting them to think in the context of the activity, the learning naturally followed." One preservice candidate wrote: "The most frustrating situation I saw was the different rate of learning and trying to keep everyone involved and interested. I think it was imperative to keep them moving and doing all the different kinds of activities so they did not have a chance to get bored. At the same time some of them needed prodding, others seemed to love a challenge." Finally, one student wrote: "The kids at Timber Lane might think of themselves as young learners, but as I am building my own philosophy of education and filling my mental toolbox with teaching gadgets, the young learners at Timber Lane became young teachers to me."

Learned about Technology in Educational Settings: Differences in the two experiences were reflected most dramatically on the last question – what did you learn about technology in educational settings. The reflections of those who participated in the field experiences are best illustrated by the following three quotations. First, "I learned that you must start with elements such as pointing, clicking, and dragging with the mouse. I learned about some programs for the teaching of ESL which allow for the differentiation of instruction, voice recognition, and the saving of tests." Second, "Technology in educational settings is neither good nor bad. Computers certainly helped in the creation of a school newspaper, but as to whether or not they enhanced the learning or creativity of students is somewhat questionable." Third, "The primary thing I learned about teaching and using technology is that it will likely make my teaching job harder. I base this assessment on the following observations: 1.) Most teachers oppose the use of technology in the classroom; 2.) Teachers who use technology have a high price to pay in terms of their time and energy commitments; and 3.) The teachers I observed who, in essence, were nibbling at the edges of technology utilization had to devote a significant amount of time to their preparation for the technology they were using.

The reflections about technology in educational settings written by those who participated in the Timber Lane Tales project were much more positive. One preservice candidate wrote: "The use of computer technology was an attraction to the students and helped in drawing their interest to the lesson. The effective use of technology to aid problem-solving was dependent on the student's underlying reading and cognitive abilities. Technology can help teach these skills but cannot substitute for them." Another student stated: "Technology can be used within a lesson or content area without taking a lot of time to teach students how to use the technology. I think teachers should lean toward less technology instruction and more toward content area learning with technology as a tool that you become more and more proficient with over time." A third preservice candidate reflected: "Even though I worked with different programs in

different settings, I almost forgot that we were integrating technology into the lessons. I learned that technology can enhance the problem-solving process and bring lessons to life for students. In these moments learning and problem solving become animated. Technology and computers give students a way to take a bit of control over their own learning."

Lessons Learned from Timber Lane Tales

Clearly, this study is preliminary and exploratory. Yet, the contrast between the reflections of those who participated in the field experience and those who participated in the Timber Lane Tales project calls into question the efficacy of more traditional field experiences. Preservice candidates who merely observed classrooms recommended by contacts in the field did not provide opportunities for these candidates to observe the potentials of technology. Neither did these experiences assist students in formulating a vision of how technology integration can support the teaching/learning process. The reflections of those preservice candidates who participated in field experiences suggest that they are not sophisticated enough to distinguish good practices from questionable practices. They are not skilled enough to understand their potential role as an educational leader and reformer, capable of bringing new practices into schools. The ways in which they saw technology being used spoke more loudly than their university classroom experience. As one of the preservice candidates who completed the field experience wrote: "I learned that there is a wide disparity between much of the course materials and teaching approaches in EDIT 504 and anything I will likely use in my classroom." The field experience observations did not meet the intent of the assignment – to provide learning experiences that bridged theory and practice. More traditional field experiences may, in fact, be counterproductive.

Conversely, the reflections of those who participated in the Timber Lane Tales project suggest that their experiences actively teaching with technology as an integrated part of the teaching/learning process assisted them in developing an image of how technology can be used. Their experiences seem to have provided these preservice candidates with a vision of how their course work (theory) can translate to the design of learning opportunities for students (practice). The reflections of these preservice candidates suggest that rather than observing classroom practice, actively teaching with others who are using models of effective technology integration is more likely to promote a sense of innovation and possibility. As one student wrote: "As for me, I was glad to be a part of it, and I think I gained more experience than if I had just been in the classroom as a student." In addition to supporting bridges between theory and practice, the more active involvement of the Timber Lane preservice candidates helped the candidates build a sense of personal efficacy. They developed confidence in their ability to teach students, to use technology in their teaching, and to adapt to the contingencies of classroom teaching. As one preservice candidate wrote: "Most importantly, I learned that deep within myself I really believe that I might be a teacher someday."

One might be tempted at this point to suggest abandoning field experience requirements. However, the intent of field experiences – bridging theory and practice – is a necessary component of teacher education. Projects like Timber Lane Tales offer alternatives. Yet, educational faculties do not have the resources to provide such opportunities to all preservice candidates. Perhaps a viable alternative is to build systematic relationships with graduate programs. Inservice teachers might be aided, as part of their own program of study, to develop units similar to the Timber Lane Tales project with specific target dates for field testing. Preservice candidates would then be assigned to complete field experience requirements in those classrooms, collaborating with the graduate inservice teacher. The additional resources would provide graduate teachers with the support they need to innovate in their own classrooms as well as providing field experience opportunities that are more appropriate for preservice candidates. The dyad of faculty and preservice candidate could become the even more robust triad of faculty, inservice teacher, and preservice candidate, dispelling the us/them dichotomy. As one student wrote: "I enjoyed interacting with the students and other teachers and left with positive thoughts and some funny stories to share with my family each day."

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Using Student-created Video to Enhance, to Motivate, and to Augment Research Efforts in Humanities Classrooms in Wyoming

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Abstract: This procedure is recommended as a motivational technique to follow in a secondary language arts or humanities classroom to put new life into the time-honored procedure of "writing research papers." It enables the students to use pictures in addition to words to explain concepts being researched and to explore the possibilities of words in conjunction with videos to tell the whole story. The concept of research in the remote areas of rural Wyoming, with limited hard-copy resources, takes on a new dimension.

Rationale for the Technique:

Student research efforts in high school humanities classrooms are frequently marked by lofty ideals, by rigid adherence to format, and with many discussions about the evils of plagiarism. Students often fight the initiative and see little relevance of the experience of research, as it has been typically taught, to their lives. With the inclusion of student-created videos, students are motivated to match the standards given with pictures as well as words, to follow the format with care, (in order to make the videos work), and to create original work without agony because the choice of which pictures to use, as well as what words to write, is totally theirs (McMillan and Honey, 1993).

In addition to the video technology, Internet was introduced as an additional technology to motivate and stimulate interest in producing quality work. Also, with the advent of the Internet, the sources for student reports are many and varied. The importance of evaluating the voluminous sources of information as valid or not is increased. Some times students have a hard time believing that just because a fact is published on the Internet does not necessarily mean it is always true. By utilizing assessment of the validity of a source, the teacher is adding another dimension to the quality of student research, because instead of just having one source, the student has many to use, to consider, and then to adapt or to abandon.

The appropriateness of choice of pictures also adds to the quality of research undertaken. By using pictures, the student is forced to think about the exact point to be made and to find appropriate graphic representations. At one time, I had a student tell me that he included a picture in his video simply because he liked the rap music star from the teen magazine. The research report, however, was on horses. Sometimes for teens, appropriateness is a hard concept to grasp.

Because Rock River School is located in an isolated, rural part of southeastern Wyoming and because the school has an extremely limited traditional library facility, conscious steps must be taken to motivate students to conduct quality research and writing efforts. The inclusion of student-created videos and the display of the yearly "Video Term Papers" has in itself added to the collection in the library.

Objectives of Using the Technique Include:

1. To motivate students to want to do research in a high school humanities classroom.
2. To create truly original work using pictures to augment verbal findings.
3. To maintain a rigorous format and style that does include videos.
4. To utilize technology in a creative way in the humanities classroom.

Procedure:

Students are asked to pick a topic of their own choice that is appropriate for the material being covered. Then they are asked to bring in as many pictures as they can to prove the various points that they want to make. Usually about 12-15 pictures are adequate. Traditional writing process techniques are used to process the written material they find to make their research statement. Then the computer applications OFOTO, Sprint SCAN, and Adobe Premiere are used to create original Quicktime videos to enhance the research points made. Then the students are asked to design a presentation using Hyperstudio or even HyperCard to present their research findings to their peers. Finally, direct instruction is given in public speaking techniques.

The younger students (grades 7 and 8) are given suggestions for choice of topics that are of high interest to them. The older students (grades 9 and 10) are given more direction in choice of topic, relevant to what they are reading or even working on in other classes. The collection of pictures can begin as soon as the topic is chosen and the approach conceptualized. Formalized note taking from sources is encouraged, and exact citations are required, so that questions like "what page was that on?" are avoided. While direct outlining is not required, a written plan of attack is. Students are asked to list what topics will be covered in order, and if a discussion of "most powerful presentation style" is appropriate, then that is conducted.

A draft of the paper is written and evaluated for content, format, and style. Corrections are made and saved. Then a discussion of where the videos would be most effectively placed is held. Direct instruction is given in how to create the videos using Adobe Premier, and then time for much experimentation is allowed. Finally, students place the Quicktime videos in the text of their term papers to enhance the effort. By adding the videos, the paper becomes distinctly unique to the writer and a creative delight to read. Students do not have to be told to make sure the paper is correct. They want it to be correct to add their effort to the school library, to take the effort home on a VCR tape to show mom and dad, and because of their pride of ownership. If the videos are not created correctly, usually they will not work.

Results and Summary:

After using this technique, students are motivated to complete research projects, to create original movies, and to spend the extra time necessary to complete the required tasks. They take additional pride in the final outcome because the scope of what they have accomplished is larger than typical research, as well as more relevant, because they have been able to use their creative choices to make the project uniquely their own.

The time factor involved in this project must also be addressed. The video term papers may take more time to create, but the trade-off is that the papers themselves do not have to be as long and are of higher quality. Students will learn the same research skills needed while writing a five page paper, as opposed to a twenty page paper, and they will spend more time drafting and processing when they are motivated to do a better job. This conclusion is warranted because after two years of experience, smaller papers have turned out to be of higher quality compared with the 20-page standard of the past. Also, once the technology is mastered, adding or amending the papers becomes easier and students often write more than they ever figured that they ever would. "Mrs. Reynolds, mine is 8 pages long. Is that ok?"

Students were motivated to do what used to be boring tasks. Emily, a junior said, "The research that I found was mainly from the INTERNET. I am really glad that the school has the INTERNET because I found some of my research with the touch of a button and that really helps."

Renae, a junior said, "I wish I would have done more research than I did, because that would have helped make my speech more interesting."

Zach, a sophomore, said, "The research was long and tiring, but I stayed up for hours doing it and finally I wrote it all down."

Students are extremely motivated to spend extra time on projects such as this one. Rock River School is located 40 miles from the nearest large town, and many of the students ride the bus from Laramie to attend RRS, a school of choice. When this project is begun, students get on the bus at 6:15 in the morning in order to buy 30 extra minutes of time in the computer lab to work on their projects. Also, they will elect to stay late and get back to their homes at about 6:30 p.m., after ball practice, if I supervise them in the lab. It is not uncommon to hear a request such as," Are you staying late so I can work in the lab?" Whenever possible, I try to accommodate all such requests.

Upon reflection, Tom, a sophomore wrote, "I learned from my video speech that computers are very tricky machines, and in order to succeed, you must learn how to handle them."

April, a junior wrote, "Overall, I'd say that the project was a good idea. It taught me quite a bit. Not only did I learn about communism, but I also learned quite a bit about myself."

Student work included in the demonstration are found in four categories: Hyperstudio presentations completed in the state of Wyoming "High School Summer Institute," designed for sophomores from around the state; video term papers from my language arts classroom; videos that were included in speeches given in the language arts classroom, and finally, videos that were included in state competitions for technology utilization in FHA (Future Homemakers of American) presentations.

Technology in the humanities classroom: word processing, Internet, and video creation, has enabled students to want to work, to be concerned about correctness, to experiment with creative choices while learning the required skills, and to succeed with their lessons.

As Justin, a junior said, "...that the video added something different to a speech. It added your perspective to your topic and what your thought was of this event or idea." The he concluded, "I learn something different every time I do a computer project."

Tiffany, a seventh grader added, "The best part about all of this was the computer project. It was very fun to put all of my research together and parts of my video into my computer project. It turned out to be very interesting and fun."

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Preparing Preservice Teachers for Testing: Pilot Study on the LAN

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Abstract: This paper will describe the process that was followed and the outcome of initiating an online instruction and testing environment which was setup on a LAN network at University of Houston Downtown in preparation for the Bachelor of Science in Secondary Teaching of Computer Information Systems, which is presently going through the approval process. This testing environment was utilized as a pilot program prior to moving to online testing on the Internet. We can use the experience of this online testing environment to move to an Internet environment that can be used by teachers globally. This online testing experience will expand the preservice teacher's experience in preparing them for the electronic classrooms of the future.

As stated above, this project was designed to develop and utilize online testing templates and online interactive tests for objective (true/false, multiple choice, and short answer) type testing. Tests and testing templates were developed utilizing *Toolbook II Instructor's Course Management System* by Asymetrix that is designed to be used on the LAN or WWW without concern for the loss of test security or integrity. It was the opinion of the developer that utilizing online testing software should provide more than just a formatted word processing document that contains test questions, blank spaces for answers, which was made available to many users simultaneously in an online testing environment. The online testing software, Toolbook II was selected because it, supposedly, performed several different functions required by the developer. As a pilot test tool, it was the opinion of the developer that, all tests could later be modified to include distribution over the Internet, should the pilot testing prove to be satisfactory.

There were two goals associated with this project. One goal was to develop a multimedia testing template which would be used for generating a test on the LAN. The second goal was to generate tests that could be given to students at multiple locations without relinquishing any of the integrity and security found in a hard copy test given at a single site.

The developer's objectives for this paper were to describe the process that was followed in developing the online tests and the evaluation of the results of the tests. The developer created several small chapter quizzes for the class to familiarize the students and the developer with the problems inherent in such a setup, as a pilot test of the template. Then the developer utilized a parallel test for students that utilized a hard copy test and also a computerized test that was completed to see if there were any problems when students complete the longer computerized test. The ultimate objective was to conduct all testing utilizing the testing software on the LAN. As an additional objective, after completing the test, copies of the test questions & their scores were e-mailed to students for review.

Test administration was handled by the computer with the goal of allowing several students to take the tests simultaneously or at a later time. Students did benefit from using this testing technique since they were able to get immediate feedback that indicated how well they

comprehended some topic. In addition, many administrative reports were available to instructors reporting the results by question, student, class, timing, etc.

In conclusion, the format of this paper will conclude with descriptions of the following: students' reactions and problems on Test Day, analyses of the students' performance, student comments regarding the test, analysis of a feedback questionnaire given to students, and an assessment of benefits and challenges of online testing.

This paper examines the process that was followed and the outcome of initiating an online instruction and testing environment which was setup on a LAN network at University of Houston Downtown in preparation for the Bachelor of Science in Secondary Teaching of Computer Information Systems, which is presently going through the approval process. This testing environment was utilized as a pilot program prior to moving to online testing on the Internet. We can use the experience of this online testing environment to move to an Internet environment that can be used by teachers globally. This online testing experience will expand the preservice teacher's experience in preparing them for the electronic classrooms of the future. As stated above, this project was designed to develop and utilize online testing templates and online interactive tests for objective (true/false, multiple-choice, and short answer) type testing. Tests and testing templates were developed utilizing *Toolbook II Instructor's Course Management System* by Asymetrix that is designed to be used on the LAN or WWW without concern for the loss of test security or integrity. It was the opinion of the developer that utilizing online testing software should provide more than just a formatted word processing document that contains test questions, blank spaces for answers, which was made available to many users simultaneously in an online testing environment. The online testing software, *Toolbook II* was selected because it, supposedly, performed several different functions required by the developer. As a pilot test tool, it was the opinion of the developer that, all tests could later be modified to include distribution over the Internet, should the pilot testing prove to be satisfactory.

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This testing experience was utilized in an Introductory Programming Class. The class consisted of approximately 33 students: 15 females and 18 males. One student was blind and had an assistant who read each question and submitted the responses to the computer on his behalf. From observing, it appeared that most of the students were in their late teens or early twenties. Students were diverse: from different ethnic backgrounds and nationalities. Each of the students had taken at least two computer classes prior to enrolling in this class: an Introduction to Computers Class and a Class on Computer Algorithms and Problem-Solving.

The test consisted of 21 questions: 7 true-false questions, 1 fill-in-the-blank questions, and 13 multiple-choice questions. There was one question on each screen with buttons from which the correct answer

could be selected. Space was provided for the fill-in-the-blank questions so that the correct answer could be inserted. There were fixed position navigation buttons to take students to the FIRST question, PREVIOUS question, NEXT question, and LAST question on the test. There was a cover page with course number and test name, an instruction sheet with general information regarding the test. The actual test questions followed these two pages and there was a page at the end indicating the end of the test. Before beginning the test there was a login script to verify the student's last name, first name, and password. This information was appended to the grade that the student earned at the conclusion of the test. The program utilized in the testing procedure was Toolbook II and it automatically generated a log record that included details about the test administration and results: time spent on each question (up to the second), name of the question, student response to each question, summary of the answers in a short form, total session time, final score based on total number of questions. The log also recorded all the students' returns to previous questions.

There were some problems with the *Toolbook II* product's scoring. It did not always correctly record and report the answers. Because this happened for every student, the test administrators consulted with other *Toolbook II* users on their Special Interest Group LISTSERV. From the information provided therein, it appears that other users have had a similar experience with this product. With respect to customizing when developing the test, another problem had to do with having five options for the multiple-choice questions. The Toolbook II widget only allowed for four options. Long (multiple line) answers were not supported. The developers were required to create a separate text box for each multiple line answer. This was very time time-consuming and frustrating. The developers wanted to randomize the questions and the responses to each question. There was no way to randomize the questions. *Toolbook II* was able to randomize the responses to the multiple choice questions when there was a maximum of four responses. *Toolbook II* would not even randomize the responses when there were five responses.

Feedback in text format and video with sound clips were provided to students. Text feedback worked well. The video with sound clips was enjoyed by the students. However, the clips had to play until they reached the end of the clip. If the student was impatient and did not want to wait until the end and clicked, attempting to move forward with the test, the computer paused and gave an error message requiring programmer attention.

Students were allowed to take the test at varying times over a two-day period. As a result, during the test, several observations were made. Students indicated that the questions on the screen were more concise than the questions that normally appeared on a paper and pencil test. (This may have been the case because of the limitations of *Toolbook II*'s question/response lengths.) Two students accidentally hit the power button because of the positioning of the system unit. Each of these students was required to restart the test from the very beginning. Also, this was the very first time that each of them took an online test and they were unfamiliar with the log-in and log-out procedures. The errors associated with this were caught and corrected immediately. Surprisingly, two students were startled when they were exposed to the different feedback mediums: video clips and text responses like WELL DONE. They were uncertain about whether or not they represented positive or negative feedback and what they were to do next. Some of the students felt that all the colors, sounds, and videos were distracting since they had to respond through the keyboard and view the questions through the monitors. This feedback was very different from anything with which they were familiar. They were used to black writing on white paper. Also, one student finished the test but did not log out completely to reset the answers. When a new student began taking the test, that student was able to look at the responses of the first student. When the new student noticed what was on the screen, the new student informed the test monitor who completed the log-out procedure for the first student and allowed the new student to begin.

At the conclusion of the test, each student was asked to fill out a simple questionnaire, anonymously, which was designed to provide feedback regarding the online test. The questionnaire consisted of nine open-ended questions. In summary, only 1 student out of 33 students taking the test felt that the instructions were unclear. Only 4 students reported having any trouble with completing the test. Three students said that they had a "little bit of a problem" with completing the test. Students had a variety of opinions regarding the quiz format. The two features cited by the largest number of students were (1) that it was clear and easy to figure out and (2) they felt the quiz provided good feedback. Interestingly, they also seemed to feel that the questions on the online test seemed to be shorter and easier to read, and they, therefore, were required to spend less time

completing the questions. Thirteen students indicated that they disliked having a time limit. Since all questions did not have feedback associated with them, seven of the students indicated that they did not like the lack of feedback on some of the questions. Another comment that merits note is that some of the students indicated that they did not like the restriction that prevented them from returning to a previously answered question.

Students did have suggestions as well as criticisms. They wanted to be able to change an answer and they also wanted their score to be displayed at the end of the test. Colorful pictures and video clips were cited as a distraction. (However, some students had noted that this was a positive enhancement to the test.) When students were asked how the online quiz compared to a hard-copy quiz, they indicated that the online quiz was more fun and looked better than a hardcopy quiz. Having a time limit was the biggest concern shared by students when asked how they felt about taking a test online. Over half of the students provided positive comments in regards to taking the test online. Only two students said they disliked taking the test online. Seventy-five percent of the students reported that they felt they earned a passing score. In terms of other comments, students suggested that this testing format would serve as a good practice test and wanted more practice with online tests. Students were quick to note that this would be a good arena to use to take tests at home, as well. Also, someone suggested the use of a "happy face" instead of video clips. They were uncertain about the connotation denoted by the video clips.

The purpose of this pilot study was to prepare preservice teachers for teaching in an environment that utilizes online testing: a given in tomorrow's classrooms. In *Restructuring Texas Teacher Education Series 7: Technology*, published by the Texas State Board for Educator Certification, the authors provide an analogy between technology education and the automobile (Diem, Martinez, & Perez, 1998). In the early 20^{th} century, the automobile was so new that it was considered as a radical departure from the horse and carriage. It was difficult at that time to foresee the universal use of automobiles that we have achieved some nine decades later. So, too, is it with the use of online testing systems. Today, in its infancy, there are still many shortcomings that have been brought to our attention. One day, the technology will mature and this testing medium will be a common practice for classroom teachers. This is what a future oriented teacher education program must foresee so that tomorrow's teachers are prepared to teach in tomorrow's classrooms. Rather than waiting to see what tomorrow's classrooms are like, today, preservice teachers must experiment with effective applications of computer technology in the classroom by learning through their own campus experiences.

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Bells and Whistles or Effective Instructional Presentations

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Abstract
An increasing number of instructors at all levels of education are using presentation software to accompany lectures. These presentations can include graphics, photographs, animation, video, music, voice files, and a variety of text fonts and sizes. The ease with which a variety of media can be incorporated into the presentations makes it very possible that more attention will be paid to the inclusion of theseAbells and whistles≅ rather than to the actual instructional impact of the presentation. This paper addresses ways of looking at the structure of the presentation frames and some suggestions to improve the instructional impact of instructional presentations.

Introduction

More and more instructors are using programs such as APowerPoint" or ACorel Presentations≅ to create visuals to accompany lectures. These presentations could do more to enhance student understanding and learning if we take a conscious view of how the screen is designed. Aspects of visual design principles are useful but if we intend them to aid instruction, we need to consider how learning theory may inform our design choices. In considering what learning theories might contribute to the process we will address aspects from gestalt, cognitive, and constructivist theories which can provide a framework for screen design and presentation flow which has theoretical underpinnings.

Gestalt Theory

Gestalt theory is considered for two reasons: 1) Gestaltists are the precursors to modern cognitive theory, and 2) Gestaltists addressed perception. Learning from a Gestaltist point of view involves the formation of memory traces. According to Koffka (1935) information follows the laws of Perception and memory traces tend to organize and simplify the information contained in the memory trace. This view of learning evolved from how Gestaltists viewed perception and how individuals organized what was perceived.

How the learner perceives what is presented is important for how they will interpret what is presented. Individuals organize visual fields into visual patterns. These are grouped according to the Gestalt Laws of Perception (Kohler, 1947; Koffka, 1936). According to Moore and Fitz (1993), these principles can be used to inform the design of printed materials. We suggest here that the principles set forth by the Laws of Perception apply equally to the computer screen. The Laws of Perception that will be discussed here are: figure-ground relationships; proximity; similarity; and simplicity.

Figure-ground relationships indicate that the background should be very distinct from the foreground. This principle is often violated in presentations. With the built-in backgrounds in presentation software, there is the danger of pairing a patterned background with text that fades into parts of the background because of a similarity in color and intensity. The example that springs to mind is the use of the clouds in the sky background with blue text. Sound that is incorporated into a presentation can also violate this principle. For example, we have seen music included which the speaker turned up and then tried to talk.

The speaker=s words were lost and had this occurred in a situation where we were expected to learn the material, we would not have done so because the foreground (speech) faded into the background (music). Another aspect which figure-ground relationships should be used to inform is text font, size, and color. The text should be distinct from the background. When a learner has to work to separate text from the background or decipher the letters of an ornate font, it hinders the learner =s ability to understand and learn. In addition to figure-ground relationships, we need to consider the law of proximity.

Simply put proximity says that objects placed close together will be grouped together by the learner. When more than one graphic is used on a frame, the labels used to identify each graphic should be placed carefully so that there is no confusion, about which object is which. In addition, when more than one concept is presented using text, there should be additional space between concepts. This cues the learner both verbally and visually. Another law of perception that can aid our screen design is the law of similarity.

The reconstruction of information can be aided by directing attention to specific items in a visual display (Kohler, 1947). This is quite easy with computer presentations. Animated text, using a different color font for key words or phrases, and flashing text can direct learner attention. This can also be used to animate graphics or parts of graphics to focus student attention on processes. When all text is the same or when a process in not animated, it is more difficult for students to focus on the key features. Misuse of features by including animations or flashing which is not directly relating to the main points or topic can become distracters. This happens often when animation is included with the sole purpose of entertainment. In some instances this may be appropriate for a break in the instruction but if it occurs on an instructional frame it can distract the learner from the information that you want them to learn. Simplicity is another tool that we can use to help improve our instructional computer presentations.

Individuals will simplify what they perceive based upon their previous experience and current expectations (Kohler, 1947; Koffka, k1935). This means that the viewer will simplify complex graphics. Since the viewer will simplify graphics, it would be useful to start with a simplification of what the graphic should be and gradually add more to it. This way you are building experience for the learner and increasing the expectation of complexity. Also, when using visuals, look at them with a critical eye. Any unnecessary visual information should be removed so that the visual does not contain elements, which will distract the learners from the focus that you desire. For example, if you want the students to learn that the parts of the plant include: stem, leaves, roots, and flowers, you should not include such things as root hairs, stomata, and so forth in your illustration and labels. In other words, leave out information which doesn t address the objectives or goal. Besides the Laws of Perception, Gestalt theory suggests that learners will form a holistic view of information.

In order to help students develop a holistic view that is compatible with the content we can provide overviews at various times within the presentation. We may start instruction with a graphic organizer, a frame (information organized in table form), or an outline which provides an overview of the information to be presented during instruction. Another way we can approach the development of an overview is to build up a series of Gestalts. This can be done by presenting a series of computer screens in the presentation, which give small overviews of a concept or connected concepts to create an overall view or Gestalt.

Cognitive Theory

Gestalt theory is not the only theory that can aid our instructional computer presentation design. Use of a variety of concepts found in cognitive theory can also help us create better instructional presentations. The first of these considered here is cognitive mapping. Cognitive maps are also called Awebs≅ and Agraphic organizers≅. cognitive maps provide a visual referent for relationships between elements or hierarchies of related elements (Reiber, 1994). Therefore, including outlines (which we often do anyway) is supported by theory. In addition, use of graphic organizers that use geometric shapes containing text to indicate levels of information and lines to connect related information can provide a pictorial view of how concepts are related. This can make the overall concept easier for students to understand. Indeed, use of text and graphics in this manner is not only supported by cognitive theory but by gestalt theory as well. Individual elements in the graphic organizer can be displayed one at a time, discussed, then another element added until the overall structure of the content is revealed and connected.

Another area of cognitive theory that can help inform instructional presentations is concept development as put forth by

Bruner, Goodnow, and Austin (1956). In their view, concept attainment is an interactive process through which individuals create hypotheses until they have defined the concept. In addition, examples and non-examples can be used to illustrate the characteristics of the concept. This can be quite nicely done using the capabilities of the computer. Nelson and Pan (1995) suggested using the concept attainment model in elementary school science. They used AHypercard≅ to present examples and non-examples one at time while students developed hypotheses for the concept. The hypotheses would be changed as new examples and non-examples are provided. This technique is appropriate at any level of education. While their AHypercard≅ example used text, graphics, animations, video clips or sounds could be used if one of those was the best way to develop the concept. The technique of having the students develop the definition provides active engagement for students and can be facilitated using presentation software.

According to cognitive theory, relating previous knowledge to what is to be learned helps the learner retain information. When a new concept is introduced within the presentation, an effective way to create the connection is to provide questions that activate knowledge students already possess. Ausubel (1960) suggested the use of advance organizers to help students activate previous knowledge and to provide structure for the information students would be learning. While he suggested the use of text passages we believe that short videos or animations can be used in the same way within the instructional presentation.

As aspect of cognitive theory that applies to the design of computer presentations comes from Gagne=s Instructional Events (1985). Gaining the learner=s attention is one of the instructional events. Presentation software allows for the use of graphics, video, animation, and sound. These can be used in creative ways to gain the learner=s attention. The best use of these features should have some relation to the topic at hand but an occasional break can briefly distract students and regain their attention. However, it should be noted that overuse of attention getting devices can cause distraction from the topic at hand.

Cognitive theorists also state that learners need to be actively involved in the learning process. This means more than just doing something. The activity must allow students to think about the material in ways that require A deep processing≅ of the material. In other words, the activity should help students move from Aknowing≅ information to Aunderstanding≅ and Aprocessing≅ the information. This means that instead of conducting the presentation as a lecture only, it would be good to include activities that are part of the presentation. For example, in a media class one of the authors presents a variety of concepts related to visual design principles, after a principle is presented students are shown graphics to analyze and discuss as part of the presentation. After each principle the activity occurs. At the end of the presentation students are given a series of graphics to analyze using all of the principles from the presentation.

Constructivist Theory

Since computer presentations are most often used accompanying lecture, we are working from a perspective, which while it does not preclude constructivist approaches makes them more difficult. Constructivist theory emphasizes that the learner constructs meaning and organizes learning in his/her unique way (Van Glasersfeld, 1989). While the individual's understanding and interpretation of experiences is unique, it can be negotiated through social interaction. Social interaction allows for and helps create mediated interpretations of experiences and much learning depends upon communication (Vygotsky, 1981). Constructivists posit that learners need to be involved with solving problems in "real world" contexts. Often this involves group problem-solving activities.

Instructional presentations can help us provide experiences that can help students construct the understanding of a concept. Using video or animation examples that provide a demonstration simulation of an event or process can do this. When introducing students to different types of chemical bonding, we can use animations so that they can visually experience what happens during bonding. However, before the animation is started, students should be told to watch carefully and be able to explain what happens. After each animation students should discuss what was seen and how the students interpreted what they saw. The meaning of the animation is then mediated through discussion. This is not the normal procedure for a lecture class, but effectively uses presentation software in a different way.

Providing problem-solving activities based in "real world" contexts can be included as a part of the presentation. This can be something as simple as rewriting an instructional objective or as complex as analyzing environmental problems. The

problems can be assigned in small parts during the presentation or as a total problem at the end of the presentation.

Group activities related to the presentation or as a part of the presentation are easily included either as "real-world" problems or as activities that help students negotiate meaning from the presentation. Small groups of students can discuss aspects of the presentation and then report on their discussion to the whole class. At that point the instructor can facilitate the discussion so that the negotiated meaning within the class falls within the parameters of accepted meaning. A complex "real-world" problem can be introduced to the groups for their discussion. In this manner a variety of solutions and meanings are developed. The different solutions and meanings can then be discussed by the whole class and one solution chosen and tested. If the "real-world" problem is less complex each group can provide a solution for further discussion within the class.

Conclusion

In order to create more effective instructional computer presentations we need to consider more than the incorporation of "bells and whistles". Just because computer presentations allow us to incorporate a variety of media, does not mean the instruction is improved by it. We suggest that careful consideration needs to be given to how the presentations are designed. In addition, we believe that if we draw upon learning theory to help us design presentations and activities that go with the presentations we can improve student understanding and learning.

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Decision Making in Editing Interactive Video: What is the Case?

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Abstract: This paper is about dilemmas in editing video for interactive use in multimedia productions. It contains a reconstruction of the decisions made before and during the editing process. Subsequently, the consequences of these decisions are discussed within the framework of the MUST-project (MUltimedia in Science & Technology). An essential characteristic of this project is that multimedia productions are developed after deliberations in a multi-disciplinary team. The conclusion contains information about how we will proceed in the MUST-project after the lessons learned during the process of making editing decisions of interactive video in multimedia productions.

Introduction

This paper discusses the design considerations and decisions made during the editing of a video, reflecting real classroom teaching, which will form the core of a multimedia case for use in pre-service teacher education. This central position of the video is also mirrored in the opening screen of MUST products (Fig. 1).

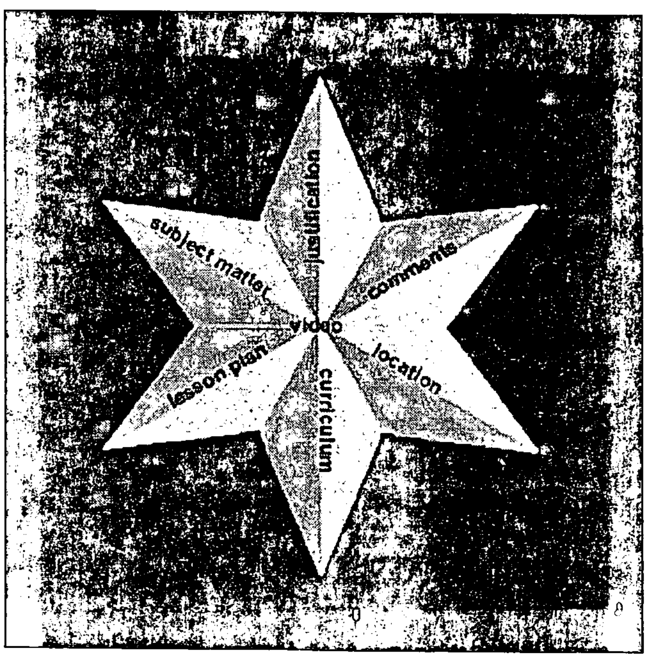

Figure 1: Opening screen of MUST products

Developed within the framework of the MUST-project (MUltimedia in Science & Technology) the multimedia case aims at stimulating and facilitating prospective teachers' reflection on learning and teaching in elementary science and technology (Van den Berg 1998). In this paper, we briefly address the educational advantages of interactive video with a multimedia production (for a more elaborated reasoning see Van den Berg 1998). Secondly, we describe the design decisions before starting the recording of the video of a theme of five lessons on *color and light*. In the third section we present the reasons why we changed our initial design decision to edit the six hour footage in a 30 minute video clip. The fourth section is the core of this paper, in this section we reconstruct the editing process and the discussions about these editing decisions in the MUST project team. Some final remarks are highlighted in the concluding section.

Multimedia Cases in Teaching Education

Cases and case-based instruction are used to bring the complexity of classroom teaching into the educational program (cf. Lacey & Merseth 1993). Video appears to be a more promising media to capture this complexity than that of written text. Video that is embedded in a multimedia environment offers important additional advantages (Van den Berg 1998), such as:

- the possibility to show the case of myriad perspectives;
- stimulating an active learning attitude in a learner-controlled environment; and
- the possibility to repeatedly view a chosen fragment of the video.

Decisions before Recording

As stated earlier, the aim of the interactive video is to reflect real classroom teaching with the intention to provide ample opportunity for analysis and reflection by prospective teachers.

A series of five lessons in the science topic "color and light" was recorded. The situation was selected because of the following reasons:

- The teacher uses an innovative elementary science textbook (Maissan & Simons, 1994) and is a regular user of this textbook;
- The science topic "color and light" is complicated from a pedagogical content perspective;
- The teacher is a good (but not an exemplary) teacher.

We think that prospective teachers are provided with a challenging learning environment, because of the innovative and complicated character of the series of lessons. We also decided not to choose for an exemplary teacher, because prospective teachers may have difficulties to identify themselves with such a teacher. Their reaction on an exemplary teacher would likely be: "This teacher can do such things but normal human beings cannot" (cf. Ball & Feiman-Nemser 1988).

It was decided to record the lesson from three camera perspectives. One camera concentrated on the teacher to cover his actions. The other focused on the students to cover their actions by means of medium and close-up shots. The third camera was set on a fixed angle to shoot an overall picture in order to give an impression of the entire situation. Except for short breaks for changing tapes, there was a non-stop recording of the lessons, that resulted in about 19 hours (3 cameras x 5 lessons x 1¼ hours) of video. The choice for three camera positions was made because it gives optimal possibilities to capture the simultaneous events in classroom lessons.

Inspired by television-documentary, the initial idea was to edit non-scripted video footage of five lessons into a 30-minutes production. We thought that a 30-minute production

would provide comprehensive narrative of the lessons. However, during the editing process we changed our focus. The reasons for this decision are explained in the next session.

Decision Making: Changing the Focus

During the first phase of the editing process serious doubts came up about the how we were to edit the video footage in a 30-minute production. We had the feeling that we were loosing too much of the reality of the classroom events. A 30-minute version would result in a few loosely coupled classroom events or in a rather impressionistic view of the lessons. The first option conflicts with the starting point of showing a case as a compelling narrative. In the latter option the video functions more as an illustrative slide-show than as a source for analyses. There will be not enough details to demonstrate the reasons and consequences of the teachers' actions. For example, you wouldn't be able to show the result of a misconception in the teachers' instruction on the concept building of the pupils by showing their discussions with each other. Both options also imply the inevitability of using a voice-over to explain and connect the impressions of the events. However, a voice-over will impose one specific interpretation, which may obstruct students to make their own interpretations.

Since neither of the options seemed to be in line with the rationale behind the MUST-project, we dropped the idea of a 30-minutes version and the use of a voice-over. Instead, we included as many details as -in our view- would be necessary to enable the possibility of thorough analysis and reflection by prospective teachers and ordered the shots in a chronological running story. After consulting members of the MUST-team, the decision was made to produce a much longer video of about 2.5 hours. An important reason for this decision was also that we are talking about *interactive video*. Computer technology provides users with the possibility to skip and to access different parts very quickly. Thus, by no means users are supposed to view to entire video at once. They have complete control over the way they want to watch the video.

Deliberations within the MUST-Team

The MUST-team is a multidisciplinary team that embodies curriculum specialists, science teacher educators and specialists in educational technology. However, the specializations in the MUST are not completely mutual exclusive. For example, one of the curriculum specialist has also a firm grasp on the field of educational technology and all teacher educators have some experiences with curriculum development, whereas the curriculum specialists have at least a strong affinity with elementary science. An important point for the discussion is that two of the teacher educators in the MUST-team are also the authors of the innovative textbook on which the video lessons were based.

Although the decision to extend the video was made after consulting especially the teacher educators in the MUST-team, showing a draft of the first part of the video resulted in rather fierce debate in the team. This first part consisted of an essential characteristic of the innovative textbook: starting with preconceptions of children by means of an identification story. In this story a girl and a boy go to a shop to buy a sweater for the boy. The girl takes a red sweater outside to inspect the color in daylight and is nearly snapped as a shoplifter, but the shopkeeper understands why she took the sweater outside. Her friend, however, thought she was very stupid, because a red sweater is a red sweater, whether you see it inside or outside the shop. After this story, the textbook contains some examples of children expressing their views on the relationship between color and light.

The teacher implemented this part of the textbook by asking a child to read a part of the story aloud, and after a while asking another child to continue. Subsequently the teacher read the conceptions of the children in the book and asked his learners with whom of the children they agree. The reading part of this lesson was included almost completely in the video. In the

discussion part some cuts were made. The criterion for editing was that the variety of reasons expressed by the students should be included in the edited videotape. Consequently, if two students expressed more or less the same opinion, one of them was left out. In order to make this selection, we took into account the number of times a student was already in the video, because we intended a more or less equal division of the appearance of students on the video. Besides, also technical and esthetical considerations played a role.

The debate after showing a draft of the edited first part of the video concentrated on the following issues:

- Elementary science portrayed as reading and discussion;
- The intentions of the authors of the book versus the teacher's interpretation;
- Motivation and concentration of prospective teachers.

One of the curriculum specialists in the MUST-team and an advocate of hands-on science reacted quite furious that the tape started with reading a story. According to him the precious time available for elementary science should not be spend on reading. One of the team members (and author of the textbook) reacted that starting with the preconception is perfectly in line with a constructivist approach of elementary teaching, so it is not the reading part that is essential in this lesson start, but the opening of children's' conceptions.

However, both authors of the book were rather disappointed that their textbook was so explicitly portrayed as textbook reading. They perceive the identification story to be implemented as a small group reading and discussion activity, in stead of rather conventional classroom reading. They would like to stress this reading part in the video more according to their intentions then according to the actual implementation. Fulfilling their wish would imply to re-edit this part of the video in short classroom impressions and communicate the intentions of the authors by means of a voice-over. For reasons mentioned above the decisions was made not to edit the video that way.

Another serious discussion point was that the way the video has been edited is not in line with commercials or music video clips, the target group, prospective teachers, is familiar with. One of the teacher educators in the MUST-team expressed the concern that the video would be too boring in order to keep the attention of the prospective teachers. Based on this discussion, two decisions were made. Firstly, designing the interface in a way that users have a maximum of opportunities to skip and access information. Secondly, the written conceptions of children have been visualized by means of computer animations.

Conclusions

Reflecting on the process of recording and editing video to be used in a multimedia production, it is fair to say that we were rather naive at the start. During the editing process we realized that fundamental decisions had to be made. Moreover, we realized that such decisions have huge consequences for discussions within a design team. In hindsight, we may say that these discussions are worthwhile in thinking thoroughly what we really intend with edited video in multimedia cases. Do we intend to motivate prospective teachers by providing them with fancy video clips or do we want an instructional video, that give prospective teachers room for their own interpretations? If the latter is the case, the question arises whether or not prospective teachers are motivated to really study the actual processes that go on during classroom teaching, because a normal elementary school lesson has very little resemblance with a MTV video clip. In order to overcome this dilemma, the next step in the MUST-project is to give teacher educators and prospective teachers the opportunity to select and comment on those fragments, they are really interested in. In this way they are invited to construct their own cases.

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Charting Our Progress: The Evolution of a Master's Degree in Educational Technology

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"At the end of the millennium in which the idea of the university has blossomed, population growth is outpacing the world's capacity to give people access to universities. A sizable new university would now be needed every week merely to sustain current participation rates in higher education. New institutions are not being created at this frequency. A crisis of access lies ahead....the world's educators should aim to ensure that all people can develop their potential in the essentially unlimited domain of human skill and intellect." (Daniel, 1996, p. 4-5)

The principal challenge to the flexibility of universities is the changing nature of the student body. Meeting this challenge requires more cost-effective methods of education and training. A steadily increasing proportion of university students are working adults who do not find attendance on campus a convenient way to learn. Lifelong learning describes the need for people to continue their education and training throughout their life as they face multiple careers and longer life spans than in the past. Daniel (1996, p. 7) states that the term "learner" now designates a role, not a person.

Many universities, including NAU, have reacted to the challenge mentioned above by adding new programs and services. Kauffman (1980) distinguishes a system from a "heap": A heap is something made up of a number of parts, and it does not matter how these parts are arranged. Graduate programs are many times offered as a heap--made up of a number of courses, and it does not matter how these courses are arranged. The educational technology faculty at the Center for Excellence in Education are concerned that these programs and services are based on a university as we've always known it in our lifetime, and that instead, we should be creating new environments that are much different than what we've known. These concerns have led us to propose a four-pronged system of professional development for inservice teachers seeking Technology Leader status: 1.) professional development certificates/credits for Arizona teachers; 2.) Technology Leader Certification for Arizona teachers; 3.) Master of Arts in Educational Technology for Technology Leaders; and 4.) a Web-based M.Ed. of Educational Technology program and a Certification program for Technology Leaders anywhere in the world. A first priority for CEE is the planning of an M.Ed. in Educational Technology for Technology Leaders in Arizona.

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Distance Education

Instruction Delivery Systems for 21st Century Graduate Teacher Education

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Abstract: This special interest group (SIG) discussion will provide an opportunity for teacher educators to share their expertise, questions, thoughts and hopes about the ways graduate teacher education will be delivered in the new century that is virtually upon us. A set of questions, issues and story starters are provided to initiate discussion. The SIG leader has been using distant technologies in the graduate learning process for more than four years and has been teaching graduate technology education courses since 1985.

Setting the Stage

As this century draws to an end, graduate classes are offered increasingly as distance learning. Anytime, anyplace web-based classes are replacing or being offered alongside traditional ones as are synchronous (at a set time) distant classes. This SIG forum will seek to identify optimal climates for delivery of graduate teacher education in the 21st century. Discussion will focus on physical, virtual, and hybrid (some residence requirement) classrooms, synchronous vs. asynchronous communication, the role of talking heads in distance learning, and the electronic tools that enable new ways to teach and learn. Below are discussion questions to start the process. Any participant may raise a new idea or issue. The only limitation is that remarks be specific unto post-baccalaureate teacher education. If requested to do so, the leader will demonstrate some of the tools used for asynchronous class discussion, one-on-one communication, and homework submission.

Issues for SIG Discussion

- To provide a start point, describe the features of a traditional class: physical attributes, number of students, methodology, events of instruction, meeting times, respective roles of teachers and students.
- Describe the features of an on-line class: range of communication tools and their functions, methodology, events of instruction, respective roles of teachers and students.
- What is the role of the teacher in a graduate education course? How is this role impacted when delivery moves from the classroom to the Internet or other distant medium?
- What are the advantages of sharing physical space and time?
- Provide examples of ways in which stated advantages are carried out in distance venues.
- What are the advantages of anytime, anyplace learning?
- How can collaborative learning, research and development occur across great physical distances?
- Discuss scalability issues. At what point does a physical class become too large for individual participation? How many students can a professor effectively mentor in a on-line course? How much commuting time negates any advantages of physical presence?
- How must student services (library, bookstore, registrar, bursar, office-hours, etc.) be restructured to accommodate distant learners?
- In what other ways are distant communications tools used to support young teachers?

Human Interaction During Teacher Training Courses Delivered Via The Internet

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Abstract: As teachers return for advanced degrees and universities explore alternative delivery methods involving the Internet, learning needs of professional educators must be considered. Interaction among participants is essential to the learning process. This paper reviews various methods of fostering interaction in distance learning courses.

Introduction

More teachers are seeking advanced degrees as colleges have become more willing to work with alternative scheduling. Administrators at universities see distance education as a viable alternative because it increases enrollment with less utilization of physical space. Alternative methods of delivery are attracting new audiences including the disabled, those with full time jobs who are far from the university and the children of baby boomers. Students are now more flexible in how they obtain on education and more demanding of the quality of the content of those educational opportunities. (Berge & Collins 1995b; Kaplan 1997; Nalley 1995)

Teaching and learning has traditionally been face-to-face; an apprentice with a master or rows of desks with the teacher in front. As technology increases, the distance between teacher and learner; and between co-learners often increases as well. Correspondence courses of the mid-1800s brought a chance at education to people far from population centers. These courses allowed people to learn about specific subjects and earn college degrees through the mail. In the 1930s, a new perspective was added through the use of radio and subsequently television. This allowed the students to see their teachers and observe demonstrations. In the 1980's, satellites and VCRs added more range to one way visual interaction (Lewis, Whitaker, & Julian 1995; Mortensen, Hubbard & Rodgers 1997)

When professional educators continue their education, the interaction between colleagues is essential. The sharing of experiences enhances the learning process in educators (Moonen & Voogt 1997). Muscella, Hockstader & Shapiro (1997) claim that "for teachers to adopt and sustain new approaches to pedagogy requires that they work in collaboration and have ongoing opportunities to talk about the content and craft of teaching." Kearsley (1998) claims that "The single most important element of successful online education is interaction among participants." and that the "sharing of ideas is one of the most powerful aspects of online education." Though a built in support system is available, a typical at school inservice training session and follow-up may have little infusion of new ideas. Graduate level education courses offered by colleges allow teachers from various school districts to interact, but distance and time often limit the number of teachers who can attend.

Distance education is a solution that is growing in popularity. However, when teachers are taught at a distance, chances for the essential interaction is lost. Two-way audio and two-video may return some interaction to distance education, but many schools in rural or low-income areas cannot access quality technology. However the influx of the Internet into the public schools is creating another avenue that will allow the interaction and collaboration between student and instructor and between peers to be revitalized in courses taught at a distance.

Kearsley (1998) defines online education as "any form of learning/teaching that takes place via a computer network." In the introduction to their three-part series called Computer Mediated Communication

and the Online Classroom, Berge and Collins (1995a) state that CMC has two roles "(a) generating improved technological tools that allow classes to use a fuller range of interactive methodologies, and (b) encouraging teachers and administrators to pay more attention to the instructional design of courses." CMC can restore the feeling of community that is often developed in a classroom of teachers.

The Internet consists of several services, that when combined, can recreate and enhance the interaction possible within the classroom walls. The World Wide Web (WWW) can make these interactions simpler than in the past because all of the services can be accessed through one software package, a Web browser. Some computer mediated communication (CMC) software will be discussed here, how it can enhance teacher training course delivered via the World Wide Web, each type of software's strengths, limitations and roadblocks to deployment.

Delivery mechanisms

For purposes of this discussion, the communication technologies available through the WWW will be divided into three categories: one-way, two-way asynchronous and two-way synchronous. The one-way group includes technologies that allow the instructor to deliver the content. Two-way asynchronous technologies includes software that allows two-way communication where time is not a factor while two-way synchronous communication requires that participants be online at the same time allowing for "real time" interaction.

One way CMC

One way CMC includes a variety of media that allow the instructor to deliver content via the World Wide Web (WWW) which can include text, embedded graphics, audio and video files. Each will be discussed along with strengths and limitations.

World Wide Web (WWW)

Web browsers allow people from almost anywhere with any type of computer to access the same information. Access can also be limited to class members by adding password-protected pages.

Content can be linear or branching allowing for tutorial-like lessons. Links to other WWW resources encourages students to do additional research on their own. Instruction can be added to or modified at any time. The format of the Web allows for the combination of text and graphics displayed in a web browser. With additional software, sound and video can be added. The ability to combine media makes the Web an ideal means for delivery of course materials.

Graphics

Photos and other graphics enhance any lesson presentation by adding variety and clarification. Images can be viewed within most web browsers. However, the speed at which a web page is loaded depends largely on the size of the graphics. The quality of the graphic depends on several factors including method of creation, type of graphic and amount of compression. In many courses, clear, detailed graphics are essential to the course content.

Audio

Audio files cannot be directly but require additional software to be linked within the browser. Audio can be used to explain a graphic or deliver an entire lecture. Developing technologies allows students to listen to a class lecture at the same time it is being given in a different location. For both pre-recorded and live audio files, quality depends on recording method and quality, speed of the computer connection, quality of the receiving computer components and activity on the Internet at the time of download.

Video

Video segments can be included to capture the body language of the instructor or to illustrate parts of the lesson. Video clips can enhance a course delivered via the Internet by creating virtual field trips. Video may also be viewed live with the use of additional software. Video delivery via the Internet requires

that the receiving computer have sufficient memory and speed.

Discussion

The one-way technologies can create a content rich web-delivered course. When used together (i.e. an audio explanation of a graphic, a video clip of the teacher demonstrating the steps with the steps outlined on the web page, or a self-propelled presentation with voice over) they are a powerful medium. However, Lai (1997) warns that the web should be more than "an electronic lecture-notes turner" or the self paced CAI of the 70's. The web has the capability to add the interactivity that teachers need in a learning situation.

Two-way asynchronous CMC

Two-way CMC adds the interactivity that is necessary in distance courses delivered to teachers. The asynchronous technologies do not require the learners to be online at the same time. Each will be discussed along with strengths and limitations.

Electronic Mail (Email)

Email allows for the exchange of ideas. Email can be a one-to-one or one-to-many interchange. In an educational setting, email can be used to send out notes to the entire class, ask questions of the instructor or of classmates or to turn in assignments. The biggest drawback for the use of email seems to be either students use it or they don't (i.e. too much or none). Some feel shy with the unfamiliar technology and email customs, while others feel free to ask questions of the instructor that they would not normally in a classroom setting. To facilitate email communication, a list of email addresses needs to be distributed early in the course and then an early assignment requiring an email to the instructor and to the group needs to be given.

Mailing Lists

The content of contributions in a mailing list also appears in one's email. However, when a person sends a message to a mailing list, it is distributed to everyone on the list. Mailing lists can be used to facilitate group discussions. Everyone can read the submitter's comments on a topic. Drawbacks include: some people may not contribute because everyone will be able to read what they have submitted while others deal with so much email that the class material may get lost in the magnitude.

Message Boards

Message boards are similar to mailing lists in that everyone can read and comment on what others have contributed. However, items contributed to a bulletin board are not delivered to an email account. The students have to navigate to a central location where the messages are posted. This creates the major disadvantage. If there is no motivation or reminders to visit the site, little discussion will occur.

Discussion

These three technologies remain the best electronic means of communication and discussion. They are easily taught to beginners and provide an effective means of creating interaction within groups of teachers.

Two Way Synchronous CMC

Two way synchronous CMC allows for more interaction but requires students to be online at the same time. Each will be discussed along with strengths and limitations.

Chat

Chat groups allow students to type messages to others in a virtual "room" and the message will appear on everyone's screen almost instantaneously. Chats allow for open discussion and instant feed back on ideas, but it requires a set time for meetings.

Audio Conferencing

Audio conferencing is similar to a phone call over the Internet. This method will allow two people to exchange ideas in a voice mode in real time. Currently both parties need to have the same software and

know the other's Internet Protocol (IP) address. Often with dial-up Internet service providers the IP address is assigned dynamically and is invisible to the user. Software, IP address identification and limitation to two-party communications are impediments to use of audio conferencing to increase interactivity in a course. Audio conferencing adds the capability to hear the inflections in the other party's voice.

Video Conferencing

Video conferences have the same advantages and disadvantages as audio conferencing. An additional advantage is being able to see the person or group with whom the student is communicating. Body language adds to the overall communication. Disadvantages include the extra bandwidth required to carry the image slows the communication or the image may be of poor quality distracting from the message.

Discussion

The main advantage of two-way synchronous CMC is the feeling of an in-person discussion. Questions are asked and answered as if the participants were in the same room. Disadvantages include the fact that participants need to be available at the same time and able to log on to the Internet. Often schedules conflict or the equipment may cause a missed meeting. Another disadvantage may be that the answers are instantaneous and may not involve in-depth thought. Follow up discussion could be left to the asynchronous methods of CMC.

Discussion

Knapczyk and Rodes (1995) suggest that professional development needs to be on-going and not the "sit and git" one shot inservice of the past. They suggest that the most practical method for the training is a cooperation between school districts and universities via some means of distance education.

The largest problem inhibiting the use of distance education at the university level is faculty buy-in. There appears to be a lack of administrative support at many universities. An instructor from New Zealand stated that at her university, instructors at a distance are paid less per course (Campbell, 1997). Concerns of faculty include time to develop, deliver and support the courses, class size, and their own skill level in course development. Kaplan (1997) suggests that universities have an inexpensive, dedicated labor force in their own students. The instructor would be the content expert and the student the designer.

Concerns about CMC from the student's side include lack of technical skills (hardware and software), difficulty with self expression and writing skills. (Aronin,1992; Kaplan, 1997; Nalley, 1995). There are also myths to be overcome on both the student and teacher side of distance education. Kearsley (1998) lists these misconceptions about distance education: it is sterile and impersonal, it is only for "techies" or that these classes are easier than the regular class.

All of the teacher training (preservice, inservice and graduate) courses described in this paper (Aronin, 1992; Collis, Andernach & Van Diepen, 1997; Lai, 1997; Nalley, 1995; Singletary, 1995; Schwartz 1995) had minimum interaction requirements as part of the course. All also mentioned that eventually many students contributed more than the requirements. Schwartz (1995) describes a situation where a question from a student was answered by another student before the instructor saw the question.

The biggest advantage of using the Internet to enhance the delivery of inservice courses is the addition of the diversity of the learner. Traditionally, inservice courses are taught within a school district. Teachers with similar backgrounds, environments and the same administration are taught together. When the subject area is limited (such as home economics or special education) the ability to share ideas is also limited. Graduate courses at local universities combine teachers in diverse situations and allows for a wider exchange of ideas. Internet delivered inservice courses allows for access by a wider range of learners. When enhanced by the interaction possible on the Internet, inservice courses can greatly enrich the exchange of ideas among colleagues and enhance the learning experience of professional educators.

The web-based courses combined with CMC allow learners to learn at their own pace and follow their own path. Time and distance are no longer major roadblocks to the continuing education of teachers.

Web based courses also encourage teachers to use technology by requiring them to use technology. Aronin (1992) describes a project in which inservice and preservice teachers received training in email use. The teachers then were required to write lesson plans that integrated telecommunications into the curriculum.

CMC can lead to more active and interactive learning, individualization and critical thinking skills. It encourages learning for learning sake. Group based work is more accessible without massive photo copying and scheduling hassles. Peers can review and make suggestions before the product is finalized. It gives students opportunities to articulate and defend their ideas. Web based learning experiences are excellent for portfolio assessment and give students the opportunity to complete a product that would be too large for a single student and prepares the student for team work on the job. (Bazillion & Braun, 1998; Collis, Andernach & Van Diepen, 1997, Schwartz, 1995)

Conclusions

Most of the courses described in this paper used Computer Mediated Communication to supplement in-class activities. If a teacher training course is developed or altered for deliver completely via the Internet, then CMC is an essential element.

One way CMC serves as the foundation for a course delivered via the Internet. The lessons on the Web carry the content for the students to discuss. The Web can also be used by the self-motivated teacher to find materials for lesson plans, student activities and personal enrichment.

The addition of two-way asynchronous communication to a web based course adds a necessary element for staff development. The ability to question and interactive with the instructor and peers is essential in any course taken by an educator. The opportunity to discuss topics and share classroom examples and problems is necessary to teachers learning a new skill.

Two-way synchronous communication may seem trivial, but it adds an important layer to a web based course. The instantaneous exchange of ideas often sparks ideas and gives a different kind of input not capable in the other mediums described in this paper.

Web based teacher training with Computer Mediated Communication is a viable, even attractive, alternative to inservice training. Web delivered courses are like a cake. The instructor delivered material is the cake itself, the foundation. Two-way asynchronous communication methodology is the frosting, essential to any really good cake because it holds the second layer of content in place and makes the whole cake taste good. Two-way interactive technologies in a web based course are like the decorations on top, they are held on by the frosting and though not necessary just a few makes the entire cake look wonderful.

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Adding Interactivity to Web Based Distance Learning

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Abstract: Web Based Distance Learning (WBDL) is a form of distance learning based on providing instruction mainly on the World Wide Web. In developing several WBDL courses, the authors have learned much about the limitations of this paradigm, especially the lack of interactivity inherent in the Web. The purpose of this paper is to discuss some of the technologies we have used in our courses to overcome this lack of interactivity on the Web. The paper describes how technologies including Java/JavaScript, ActiveX/VBScript, a Web based bulletin board, and Web Chat can make WBDL courses more interactive.

Introduction

Social, economic, demographic, and technological changes are challenging higher education to reexamine the way education is delivered (Daniel, 1997). As a result, many American colleges and universities have begun to offer distance education courses and degrees as a way to improve access to educational opportunities for learners of all ages, at all levels, and in diverse environments (L. Parker & A. Parker, 1996). One model of providing instruction that is becoming increasingly popular is to provide instruction mainly over the World Wide Web. The authors of this paper have developed several courses using this paradigm, which we call Web Based Distance Learning (WBDL). In the process we have seen first hand some of the limitations of this paradigm and have developed several strategies to overcome these limits. The purpose of this paper is to share our experience in developing WBDL courses and to present an overview of some of the technologies available to make the Web more interactive. We believe that the Internet has the potential to be more than a compendium of information. When properly structured, Web pages can guide users through a series of instructional activities that present information, direct practice, and provide opportunity for responses.

Requiring Active Involvement

Educators generally agree that for learning to take place, the learner must actively process and make sense of available information. An active learner will integrate new knowledge more readily than a passive learner. Expert teachers are able to use many techniques to ensure the active involvement of students.
For example, classroom teachers rely on a number of visual cues from their students to enhance their delivery of instructional content. A quick glance, for example, reveals who is attentively taking notes, thinking about the lecture or a difficult concept, or trying to make a comment. The frustrated, confused, tired, or bored student is also evident via visual cues. When teaching in the classroom, you can receive and analyze these visual cues and adjusts the course delivery to meet the needs of the class during any particular lesson (Willis, 1993). In contrast, the distant teacher has no visual cues. Those cues that do exist are filtered through technological devices such as video monitors, and most are represented in e-mail type responses. It is difficult to carry on a stimulating teacher-class discussion when technical requirements and distance alter spontaneity.

Without the use of a real-time visual medium such as a television, the teacher receives no visual information from the distant sites. The teacher might never really know, for example, if students are asleep, talking

among themselves, or even in the room. Separation by distance also affects the general rapport of the class. Living in different communities, geographic regions, or even states deprives the teacher and students of a common community link. For all these reason, it becomes more challenging to require active learning in a Web based course.

One way to increase the possibility that learners actively process information is to require them to develop artifacts of their learning. Dodge (1995) summarizes eight specific strategies based on work by Marzano (1992) that can be assigned to ensure that learners produce knowledge artifacts. These strategies include requiring learners to compare, classify, induce, deduce, analyze errors, construct support, make abstractions, or analyze perspectives that they encounter while using the Web. From our perspective effective teaching via WBDL is more the result of preparation than innovation. The distance educator must employ a number of strategies focusing on planning, student understanding, interaction, and teaching to ensure a successfully delivered course. It is the strategy of interaction that we address in this presentation.

The challenges posed by distance teaching are countered by opportunities to reach a wider student audience; to meet the needs of students who are unable to attend on-campus classes; to involve outside speakers who would otherwise be unavailable; and to link students from different social, cultural, economic, and experiential backgrounds. Many teachers feel the opportunities offered by distance education outweigh the obstacles. In fact, instructors often comment that the focused preparation required by distance teaching improves their overall teaching ability and empathy for their students.

The major shortcoming of using a Web page to teach is the fact that the Web was designed to be an information dissemination technology. Web pages, by their nature, are not interactive. It might be useful to explain exactly what we mean by interactivity. First, we mean that Web pages themselves need to become more interactive. This type of by interaction is the ability of a computer program (or Web page) to modify itself based on user input. Much of the computer-assisted instruction in the first decade of the microcomputer revolution was criticized because they lacked this sort of interaction. The were essentially "electronic page turners." We concede that the non-linear, hyperlink interface of the Web is superior to page turning. However, the language used to develop Web pages, the HyperText Markup Language (HTML), lack the ability to perform simple functions like asking the user a question and providing feedback. To help overcome this lack of interactivity in HTML, both Java/JavaScript) and ActiveX/VBScript) can be used. An overview of each technology is provided below.

Second, we are also interested in other technologies that can make WBDL courses more interactive, both synchronously and asynchronously. The last section of the paper presents some specific tools we have used for asynchronous (a Web based bulletin board or conference) and synchronous communication (Internet Chat).

Technologies for Making Web Pages Interactive

In attempting to make Web pages more interactive, we have explored and implemented many alternative technologies. In this section we present an overview of some of these Java/ JavaScript and ActiveX/VBScript, two technologies designed to increase interactivity on the Web.

Java/JavaScript

Java and JavaScript are object-oriented programming languages that have taken the Internet by storm. Java's popularity lies in its purported ability to work across platforms. While we recognize that Java and JavaScript are quite different, they both provide the ability to make Web pages interact with the user. The Internet no longer need remain a static vehicle and becomes a truly interactive tool for the user. It is here that we find its major value for the educator.

As noted above, both Java and JavaScript are object-oriented. This means that you can create a variety of different types of objects and place them on your Web page. The actions these objects perform depend on the characteristics and behavior of object. Java applets (programs that run in a Web environment) and JavaScript

scripts (programs written on the Web page) can be used to determine the actions of interactive elements like check boxes, text boxes, buttons, and like objects.

One of Java's great advantages is its inherent security. Because it was created to run applications over the Internet, its designers were very concerned about security. They had to be careful to make it impossible for malicious programmers to build Java applets that could reach over the Internet into users' machines to steal passwords, shut down systems, or perform other unfortunate hacks. To guard against this, Sun developed the "Java sandbox," (referred to as a virtual machine) inside which Java applets are forced to run. This virtual machine blocks all access to potential danger zones on your computer, such as the hard disk and serial ports. While the sandbox makes Java very safe, it also makes Java work slower and somewhat less efficiently than native applications that run directly on your machine without any intermediary processing. (Rowley, 1995, http)

One major problem with Java and JavaScript is that they are based on the computer programming language C++, one of the more difficult languages. Educators building their own Web sites are generally not programming gurus and not Java programmers. In fact, very few Web sites are actually built by professional programmers. That's why programs like Lotus BeanMachine® and Hot Potato® (discussed below) are important: They bring the power of Java to non-programming Web-builders like teachers and their students.

Half-Baked Software is the "nom-de-plume" of the Research and Development team lead by Martin Holmes, at the University of Victoria Computer-Aided Language Laboratory (http://web.uvic.ca/hrd/halfbaked/). One of the programs provided for free on their Web site, **Hot Potatoes**, is an excellent way to quickly create interactive teaching exercises using a combination of HTML and JavaScript. The Hot Potatoes suite is a set of five authoring tools, which enable you to create interactive Web-based exercises of five basic types. The tools include a multiple choice test generator, a JCloze procedure instrument, a crossword creation program, and a short answer test generator. The tools use JavaScript for interactivity, and will work in Netscape Navigator and Internet Explorer versions 3 and above on both Windows and Macintosh platforms. The results can be used for a standalone machine, a network, a CD-ROM, or the Internet. Hot Potatoes comes with good documentation and tutorials, and the easy-to-use, fill-in-the-blanks interface means you don't need to know any HTML or JavaScript coding to create your exercises.

ActiveX/VBScript

ActiveX is Microsoft's approach to adding interactive elements to the Web. ActiveX has the ability to activate the Web by providing the ability to imbed animation, multi-media, and even entire applications directly onto Web pages (Turlington, p.1). Because of ActiveX, the Web need no longer remain static (Ernst, pax02.htm).

One advantage of ActiveX is that it is based on existing Microsoft technologies. Microsoft's strategy for adding interactivity to the Web is to provide the means for embedding computer applications (programs) on Web pages. Microsoft had already developed technologies for linking information in one application (say a spreadsheet) into another (like a word processor). The technology, called **dynamic data exchange (DDE)**, was improved to allow entire applications to be embedded as an object in other applications. This improvement in DDE, known as **object linking and embedding (OLE)**, allowed the creation of compound documents (Chappell, p. 2). ActiveX is an extension of this technology.

The most important components of ActiveX are called **controls** and **containers**. Controls are ActiveX components that can be shared by many programs (containers). Examples of controls include buttons, combination boxes, menus, icons, and so forth. The term *containers* refer to any application that accepts ActiveX controls. These applications include Microsoft Word, Visual Basic, C++, Excel, Access, and others (Williams, p. 14). It also includes ActiveX aware browsers like the Microsoft Internet Explorer (or Netscape with the NCompass plug-in).

Microsoft has provided a simple, easy to use application that enables one to easily create new controls. This application, which works like Visual Basic, is called the ActiveX Control Pad (Lemay, L., p. 4, 5). The

interface of this program is intuitive and quite similar to the Visual Basic interface. You simply create controls by selecting them from a toolbox. You then set their properties from a properties window and attach any code (or script) to the object. Of course, the scripts are written in the familiar Basic language. You can also develop ActiveX components using Microsoft's Visual Basic.

In many ways, ActiveX technology provides many advantages to Java including speed and ease of development. However, as noted above, Java is much more popular. The major reason for this is the security concerns noted above. Web developers should be aware, however, that there are no security problem caused by adding ActiveX controls to their pages. The problem can only occur when you browse to site with a mischievous application embedded on its page.

Other Interactive Technologies

In addition to using both Java and ActiveX elements to enhance the interactivity of course Web pages, we have also explored other technologies to add interactivity to the class itself. The rest of the paper describes of an electronic bulletin board useful in holding class discussions and the use of live, synchronous chat. The program we used as the electronic bulletin board, WebBoard (O'Rielly, 1997) is described below.

The WebBoard

In our earlier Web Based Distance Learning courses, we used a listserve as a means of holding class discussions. While this was a useful technology, there were several shortcomings. First and foremost, we found ourselves at the mercy of our Academic Computing department. We found it difficult to set up the list the way we wanted it. For example, our AC department could see no reason to allow archiving of messages. This means that if a student joined the list late, there was no means of finding out what had been discussed in the passed. Another shortcoming of listserves is that the messages are not threaded. That is, they are not organized by topic. In a typical WBDL course, several topics are being discussed simultaneously, and it can be quite confusing trying to determine what comments went with which threads.

To solve this problem, we are currently using the WebBoard developed by O'Rielly (1997). This server essentially acts as a front end to a Microsoft Access® database that keeps track of all messages posted. It organized the messages by topic, making it easy to follow a particular thread. The WebBoard also provides many useful administrative tools including keeping track of every time the Board is accessed. This makes it easy to see exactly how often each student contributed to the discussion.

One disadvantage of electronic conferencing on the WebBoard is the fact that all of the discussions are asynchronous. While there are great advantages to this approach, it does not allow for the free exchange of ideas that actively involves students in class discussions. To overcome this, we have used the Chat facilities of the WebBoard, to have synchronous, on-line discussions. The final section of the paper describes our experience in using this and other Internet Chat technologies.

Chat

Internet Relay Chat (IRC) or Chat conferencing systems allow for a group-based interaction using text. IRC allows "real time" electronic conversations between hundreds of users. IRC has different channels and each channel contains a separate conversation. You can move from channel to channel, and you can send messages to "page" people who are on other channels. (Kroll, 1992) Every IRC and maintained by a channel operator who controls the channel. The operator may make the channel private, remove users or shut down the channel. If you want to set up an IRC chat server you need access to an IRC chat server. The authors have access to an IRC server operated by the University Academic Computing Department. The program is the Webmaster Conference Room IRC Chat Server (http://www.webmaster.com/). FAU runs the IRC Chat Server Personal Edition version 1.3.
If you just want to get your own chat room, ParaChat (http://www.parachat.com) offers a free ParaChat Personal license. The Personal License provides a chat room that carries advertisement panels for ads. You can pick a topic and room name but no room administration (ban, set topics, web tours, open/close the room etc.) is possible. This is a good way to get a simple chat room.

Using a Chat Room

The authors establish a time via the course Listserve or WebBoard for the class or a designated group to login to the chat room. We experience better group participation when we have a defined topic or problem to discuss. Posting a topic for discussion on the listserve or WebBoard allows students to have materials and or ideas prepared for the chat session. Posting a schedule of times that the professor will be available in the chat room also provides considerable opportunity to interact with the students. Students enrolled in virtual learning communities can also collaborate using the course chat room. We suggest having a limit of 8 to 10 students in the chat room at one time as that facilitates the interaction and provides a better opportunity for all to participate. It takes the students a brief introductory time to adjust to the "rhythm" or chat timing due to the slight delay. Chat allows students to interact with one another and the instructor synchronously at times that are convenient for all.

Conclusion

While our experience has shown us that Web Based Learning classes present significant challenges to the professional who decides to implement this version of distance learning, there can be no doubt that this paradigm is becoming increasingly more popular. In this paper, we provided an overview of some of the various technologies available to meet these challenges. While true interactivity based on two way video cannot be supported by the current Web, we believe that these technologies can enhance the learning experience by adding interactivity to Web pages.

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Developing Online Courses: A Comparison of Web-based Instruction with Traditional Instruction

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Abstract. The purpose of this study was to investigate the effectiveness of an online course as compared to its "traditional" counterpart and to an "integrated" course using traditional and online instructional methods. Equivalent-form pre- and post-test measures were used to collect data used to determine statistical significance of the results. A t-test for independent means was used examine the data between traditional and the online groups. An ANOVA test was used to compare the data collected on all three groups. Information obtained from student email records, online course Chatroom comments, and instructor evaluations were also compiled and examined to assist with comparing the three courses. The results indicated that the online course was equally effective as the traditional and integrated course.

Introduction

The continual evolution of educational technologies has provided new modes for instructional delivery. Faculty at institutions of higher education can begin to develop course materials, complete courses, and even degree programs to be accessed locally (e.g., on campus) or long distances ranging from inter-county to world-wide. Given the historical commitment to outreach programs, such technological opportunities can only serve to enhance distance delivery (McKenna & Ward, 1998). While many advanced systems, such as compressed video and desktop computer video conferencing, exist and have been used successfully, costs associated with development of transmission and reception sites are typically beyond community and school-based interests (Knapczyk & Rodes, 1995). In addition, care must be given to instructional design so as to maintain instructional integrity, and, in turn, student achievement (Windschitl, 1998). Given recent advances in Internet connectivity and financial commitments towards actual home, school, and community connectivity, a new arena for distance education delivery has emerged: the development of complete web-based courses and programs. School-based personnel are especially interested in courses and programs delivered over the web given its cost-effective potential (especially in rural areas). In short, the web is increasingly appearing as a viable mode for instructional delivery (Zhao, 1998).

The author and several colleagues recently received competitive-grant funding from the State Board of Education to develop a Virtual Campus. The intent of this program is to develop and deliver a complete online masters program in education; we have begun to offer graduate courses, and the whole program will be online by Summer, 1999. The rapid emergence of courses and programs has been received with great fanfare. However, the growth of college and university courses and programs delivered over the Internet raises a key question: are these courses "equivalent" to their traditional counterparts, or is the cost-effective nature of the Internet allowing for the rapid expansion of correspondence courses? Certainly, this issue demands investigation as, from educational standpoint, we should not be reducing the instructional effectiveness of course delivery for the sole purpose of cost-effective delivery (Recker, 1997). In other words, we, as educators, should not sacrifice the integrity of our courses. With this issue in mine, we were very interested in determining the extent to which an online course "compares" with a traditional counterpart, with an exciting twist: we wished to create an online version of a course which teaches our preservice education students how to use educational technology to enhance teaching learning. In other words, we would be using technology (the Internet) to teach how to use technology.

Methods

Preservice teacher educators at the University of Idaho must complete a required course in educational technology. This course is designed to provide students with tools and skills to use educational technology in the teaching/learning environment. Students complete this course early in their program; while enrolled in methods courses, students receive additional information concerning the integration of educational technology with specific content. As a result, students emerge from our program able to use and integrate educational technology into the classroom. The technology course, titled "Introduction to Educational Technology" teaches students to use word processing, spreadsheet, database, and presentation programs. In addition, they learn how to access and manipulate digital images via cameras, scanners, and the Internet, develop multimedia instructional modules, use the Internet and email, develop web sites, and evaluate educational software. This course has evolved to its current format over the past three years. The curriculum was developed in light of our analysis as to what teacher should know regarding emerging technologies. Given the rapidly evolving nature of educational technology, we had developed our own course textbook, which is revised at least once each academic year; this text consists of information, activities, assignments, and resources to help students become technologically literate. The course midterm and final examinations consist of direct performance tests which confront students with tasks requiring them to create "products" such as word processed lesson plans, PowerPoint presentations, or documents containing downloaded Internet information. Since our curriculum was formalized, the Idaho State Board of Education has mandated that all preservice teacher educators will pass a state-certified educational technology competency test prior to receiving their teaching credential. These competencies are based upon the International Society for Technology in Education (ISTE) foundation standards. Interestingly, we found that our curriculum perfectly matched these ISTE standards, requiring no course modification.

The online version of this course was developed by creating a number of "modules" which focused on the traditional course content. The online course was carefully constructed to provide easy, rapid access to necessary information: a course introduction, how to access and use the course on campus or at home, the syllabus, competencies, and examination information, and grading information. The key components of the course consist of the Modules and a Chatroom. Each module consists of an overview, hypermedia or web based instruction, a tutorial activity, and an assignment. Similar to the traditional course, the overview provides students with general information about the module content and necessity (i.e., what multimedia development is and how it can be used in the classroom). The instruction for the module consists of either an online stack created with the Hyperstudio, or web-based instruction; either mode presents basic instruction on how to launch and use a particular piece of software or hardware. The tutorial activity builds upon the instruction by walking students step-by-step through the use of the software or hardware; in several cases, the tutorial consists of more than one activity. Finally, the students complete an assignment relevant to that particular module and submitted the assignment electronically. The online course was designed to use the course textbook exactly the same as the traditional course students. The Chatroom was designed to facilitate discussion by students to each other and to the course instructors. The course developers deemed this aspect be critical, as a replaced the "community" of learners that is created in the typical classroom. The students were able to maintain communication with their instructor via the Chatroom, email, and telephone. In addition, the Grades link allowed them to constantly monitor their progress in the course. The investigators also believed it would be interesting to teach a third course which use aspects of the traditional and the online course. In essence, students met at the regularly scheduled class time; the instructor used traditional methods in conjunction with the web based instruction modules to teach course content.

The principal investigator was responsible to ensure that the study did, in fact, examine instructional differences on a common metric. Instructor activities, materials, discussion, and tests were all carefully developed and monitored so as to prevent extraneous variables from impacting the study. The online course was developed during Fall, 1997; the syllabus, and all other relevant information was developed to ensure that students enrolled in any one of the treatments (traditional, online, or integrated course) or control (traditional course) groups would receive exactly the same information and instruction, via a different delivery mode. The study took place during the Spring, 1998 semester; students were enrolled in three education technology courses, and did not know about this study until the semester began. Students were not given enrollment choice; in other words they could not choose to receive online instruction, traditional instruction, or an integrated combination. Course assignment as a treatment or control group was done randomly; treatment "a" was the online course, treatment "b" was the integrated course.

Students in each group completed a 30-item multiple-choice pretest designed to measure their understanding and skill level of educational technology. There were informed that this pretest would not be

graded, but were asked to be honest and try to answer questions to the best of their knowledge. The average time to complete this test was 18 minutes; based upon observation, and the pretest score average, the researchers concluded that the students did, in fact, attended to the task to the best of their knowledge. Immediately following administration of the pretest, each instructor proceeded with their course. Observation of instructional activities by the principal investigator, and numerous meetings by the instructors with the principal investigator ensured that the curriculum was the same across the three groups, and that the only variation in instruction could be attributed to the mode of instruction (traditional vs online vs integrated). Students were all administered midterm and final direct performance examinations at the appropriate time. During the last week of instruction, students were also administered the (non-graded) posttested, being an exact-form of the pretest. While the items on the pre-and posttest were the same, the relative positions of the items (No. 1 on the pre-tested became, for example, No. 7 on the posttest) was changed. The researchers determined that four months time would be adequate for students to not recall specific items from the pretest. Students were also provided the opportunity to complete a university-required course evaluation; information from this evaluation, Chatroom comments, and archived email messages were compiled and examined. Testing data (Pre- and Posttest mean and standard deviation scores) are presented in Table 1.

	Traditional	Online	Integrated
N	18	16	16
Pretest X	18.84	19.63	19.10
Pretest Sd	3.47	2.68	2.63
Posttest X	23.00	22.75	22.35
Posttest Sd	2.60	2.77	2.71

Table 1: Pre- & Posttest Results

Results

At the onset of the study the researchers had decided to run two comparisons of the quantitative data. First, so as to determine whether or not there was a significant difference of between the traditional course and the online course without statistical interaction from the integrated course, a t-test for independent means was used to compare just the traditional and the online courses. Second, to determine the significance of the results in light of potential interaction between the three groups, an ANOVA was used. Both statistical analyses were tested at the .05 level. There was no statistically significant difference between the traditional and online groups on the pretest or on the posttest, which indicates that statistically, the groups were similar on both tests. There was, however, a statistically significant difference of the gain between the traditional group and the online group between the pre- and posttests ($t(32) = 0.75$, $p>.01$). The ANOVA test ($F(2, 27) = 2.218$, $p>.05$) indicated that there was no significant difference between any of the three groups; Table 2 presents the ANOVA results. An examination of the archived email and Chatroom communications along with information from course evaluations provided valuable insight regarding student perceptions of the courses, both positive and negative.

Source	SS	df	MS	F
Between	26.84	2	13.42	2.22
Within	344.94	57	6.05	
Total	371	59		
$F(2, 27) = 2.218$, $p>.05$				

Table 2: ANOVA Results

Discussion

The results from the t-test indicate a positive effect of the online course as compared to the traditional course. However, the results from the ANOVA suggest no difference between groups. Both results should be interpreted as favorable; either the online mode produced an increase in learning (t-test results), or, there was no

difference between the three groups (ANOVA results) suggesting that each are equally viable to impact (positively) student learning. In short, these results reinforces our contention that careful construction and implementation of a web-based course can provide a cost-effective mode of instructional delivery which may be used in a variety of settings.. The implications for such results should, however, be treated with caution. The authors do not believe that web-based instruction should necessarily replace all traditional instruction. Rather, educators should simply consider use of an online course as a viable alternative for distance delivery.

Overall, the students valued the online course equally with the traditional and the integrated courses, as indicated by information from electronic communications and course evaluations. An examination of the archived email and Chatroom communications revealed initial frustration with the online course. Especially impacted at this point in time were students with little or no experience in education technology. However, discussion with instructors of the traditional and integrated courses revealed similar anxiety, stress, and frustration with course content. These results are consistent with past experience in the traditional course; students are often frustrated at the onset of an educational technology course, and become increasingly comfortable with newer technologies upon establishing a base comfort zone of competency. Especially insightful were results and comments derived from the course evaluations. The instructor "ratings" were moderately high; in other words, students believed that the instruction in each course was very competent. In addition, students indicated that they enjoyed the opportunity to work at their own pace in the online course, and believe that the modules were very effective. Several students indicated that they did not prefer the online mode, and would rather work with a "real" instructor. Interestingly, while the students disliked the mode, they still rated the course high; we interpret this as a very positive commentary on course effectiveness.

The groups who participated in this study were, by and large, "traditional" students who engage in on-campus courses. While the majority of the online participants favored that mode, and that many of the traditional and integrated group participants indicated desire to take such a course, many believed that the integrated course would be best for on-campus courses. The participants would value the convenience of online instruction, but also would prefer to have the opportunity to interact with a person on a fairly regular basis. Given years of instructional experience, and our concern to maintain the "personal" aspect of instruction when possible, we support this view.

Summary

In summary, this study has been a valuable learning experience, which will help drive our ongoing online course and program development. The students also provided helpful commentary regarding instructional activities contained within the online course. We're currently incorporating these comments into our summer offerings, and will continue to modify the course for future offerings. This study serves as a pilot study to investigations which use larger sample sizes, or potentially examine the difference between course delivery modes longitudinally over an extended. We will continue to examine the development of online courses given our commitment to innovative, cost-effective distance education opportunities.

A course developed on the web which addresses "original" curriculum ensuring purposeful, meaningful instruction can be a valuable asset to persons interested in cost-effective distance education delivery systems. In terms of a comparison of the overall time to develop and teach a traditional course as opposed to an online course, certainly a far greater amount of time was involved with developing and monitoring the online course. However, once the structure and programming of the online course was established, modification of the existing course and creating of new courses is fairly straightforward. It is possible then, that an online course could, in fact, assist with time management issues relevant to typical faculty responsibilities, along with outreach obligations.

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Technology Is The Tool, Teaching Is The Task: Student Satisfaction In Distance Learning

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Abstract: A study was conducted to determine predictors of student satisfaction in a graduate nursing program taught via fully interactive, multipoint real-time video teleconferencing and World Wide Web/Internet. A correlational research design was used to examine relationships among five learner attributes and three instructional variables and student satisfaction. Regression analyses identified learner attributes and instructional variables predictive of student satisfaction. Of the eight predictor variables regressed on the measure of student satisfaction, only instructor/instruction contributes to explanation of the variance in course satisfaction scores ($\hat{R}$ = .21). Overall instructor rating strongly correlated with satisfaction. The most potent finding is that good pedagogy is important to students perceived satisfaction with distance education. The focus of faculty training and development for those who instruct in distance-education courses should be directed to development of effective instructional strategies.

Introduction

The demand for flexible and convenient education programs to support life long learning and career development is increasing. Distance education, as an instructional format, offers flexibility and convenience--characteristics sought by a growing student body. With the increasing demand for distance education and growing consumer experience with distance-learning modalities, expectations for quality instruction, successful educational outcomes, and satisfying learning experiences will rise. The cost of the technology used to deliver instruction via distance learning is high. Favorable program outcomes must be demonstrated in order to justify the expense of developing and maintaining distance learning programs. One important measure of program outcomes is student satisfaction. In order to assess and maintain student satisfaction in distance learning programs, providers must first identify the factors that are associated with satisfaction.

Although the distance-education literature is replete with research conducted in video teleconference courses (Russell, 1997) there is a dearth of research examining student satisfaction in distance-education courses employing both interactive video teleconferencing and computer-mediated communications technologies (World Wide Web/Internet, bulletin board systems, e-mail). This study was conducted to: 1) determine relationships among selected learner attributes, instructional variables (instructor/instruction, technology, and course management) and student satisfaction in a first-semester course of a graduate nursing program taught via fully interactive, multipoint real-time video teleconferencing and World Wide Web/Internet; and 2) to identify those learner attributes and instructional variables that are predictive of student satisfaction.

Conceptual Framework

Educational systems theory (Banathy, 1992) and Moore=s theory of transactional distance (Moore & Kearsley, 1996) provide the conceptual framework and guide the selection of variables to predict student satisfaction in distance-education courses. The operational model of the Department of Nursing Education at the research site was modified by the researcher to graphically depict the theoretical framework of the study. Figure 1 displays a systems model representing the interaction of components of the instructional system in this study. The four elements of the learning process component of the system represent the predictor variables which are examined for associations with student satisfaction (output) at the conclusion of a course in the first semester of a graduate nursing program taught via interactive video teleconferencing (IVT) and World Wide Web/Internet (WWW/INT).

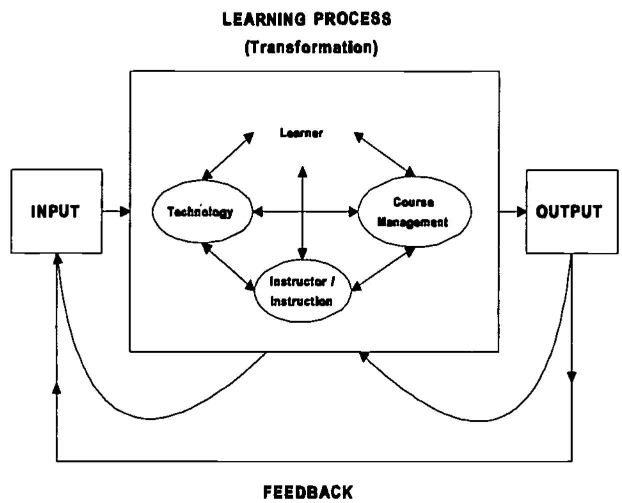

Figure 1: The instructional system in technology-mediated instruction.

Transactional distance is inherent in all educational systems. Transactional distance refers to the psychological distance created when an instructor and learner are separated by time and space (Moore & Kearsley, 1996. Transactional distance exists on a continuum and is a function of two variables: dialogue and structure. Dialogue refers to the extent to which an instructor and learner are able to respond to each other and includes all types of interactions between the instructor and students. Structure is defined as the measure of an educational program=s responsiveness to learners= individual needs. Using integrated telecommunications technology systems (technology that combines voice, sight, access to online databases, and shared communications applications) together with interactive video teleconferencing promotes both synchronous and asynchronous interaction. By increasing communication options and promoting opportunities for dialogue, structure is reduced and the transactional distance may be minimized. Adult learners who have opportunities for control over their learning and systems that support frequent and quality interactions are more likely to experience satisfaction with learning in distance education programs (Bayton, 1992).

Literature Review

The efficacy of distance learning has been widely studied. In one review of the literature (Russell, 1997), over 248 research reports, summaries, and papers exploring educational outcomes in distance education consistently demonstrated no significant differences in achievement outcomes between traditional face-to-face classroom instruction and distance learning. Yet despite a large body of research literature examining achievement outcomes in distance learning, researchers have not fully investigated the affective outcomes of distance learning (Allen, 1995; Biner, 1993). Student satisfaction is one such affective outcome requiring additional investigation.

Learner Attributes and Satisfaction in Distance Learning

Although age has not been demonstrated to predict student satisfaction in distance education (Biner et al., 1996), student attributes related to academic success and satisfaction correlate with maturity (Allen , 1995; Dille & Mezack, 1991). Older student age may be associated with expectations for higher levels of interaction and collegiality, both activities that may be limited in distance education and may therefore impact student satisfaction. The impact of previous experience with distance-education courses on perceptions of satisfaction in subsequent courses is not clearly established. Some researchers have found no differences among students with varying levels of previous experience toward IVT courses (Dille & Mezack, 1991; Sorenson, 1994/1995). Others report students with prior telecourse experience are less satisfied with the instructor and the instructional aspects of the course (Biner et al., 1996). Lack of technical competence can impact attitudes toward the technology itself, affect students = ratings

of instructor effectiveness, and satisfaction with the course (Nally, 1995). The opportunity to interact and collaborate with peers during the instructional process is linked with students= perceptions of involvement and satisfaction with distance education (Fulford & Zhang, 1993). Students who use available communications technologies to interact with each other and with the instructor between class sessions may perceive less isolation, more interaction, and greater satisfaction. The small class size at remote-teleconference sites may contribute to students= feelings of isolation from other students, the instructor, and the support services of the sponsoring institution. The size of the remote-site group may effect students= motivation, persistence, and attitudes toward the course (Biner et al., 1997).

Instructor/Instruction, Technology, and Course Management Variables

A review of distance-education literature suggests the following factors are related to students= satisfaction with elements of the quality and effectiveness of the instruction: 1) the clarity of communication and course expectations; 2) the selection, quality and instructional use of visuals; 3) the timeliness of feedback on course work; and 4) the use of instructional strategies that aid students in understanding the course content (Daines et al., 1994; Egan et al., 1992; Mood, 1995; Sorenson, 1994/1995). Factors specific to perceptions of instructor effectiveness include: 1) teacher behaviors that create a sense of belonging and inclusion in the class; 2) effective communication skills; 3) enthusiasm during instruction; 3) organization and preparation for each class; 4) access to the instructor and response for students= questions; and 5) perceptions of the instructor=s professional behaviors (Daines et al., 1994; Kooker et al., 1994; Moore & Kearsley, 1996).

Technical aspects are cited as the most frequent cause of course deficiencies, student anxieties and frustration, negative attitudes toward the course, and student dissatisfaction (Mood, 1995; Thomerson & Smith, 1996). The issues related to the deficiencies of technology use in distance education are characterized in two areas: issues related to the function and reliability of the technology itself, and issues related to the human interface with technology (levels of previous experience, operational familiarity and expertise, and techno-fear or intimidation).

Aspects of course management identified as important to students and related to their satisfaction in distance education include: 1) the clarity of class assignments and communication of course and assignment performance expectations, 2) access to campus-based resources (library, registration and records, bookstore, financial and administrative offices, advising and counseling), 3) promptness of course materials exchange between instructors and students, 4) the availability of technical support personnel during and between instructional sessions, and 5) the provision of orientation to the course, technology, and operation of the equipment (Biner, Dean, & Mellinger, 1994; Daines et al., 1994; Mood, 1995; Moore & Kearsley, 1996; Sorenson, 1994/1995; Thomerson & Smith, 1996).

Methods

Description of the Research Setting and Course Logistics

The distance-education program in this study represents an affiliation between a publicly-funded State university (SU) and a not-for-profit health maintenance organization (HMO) located in northern California. All academic aspects of the program are administered by the faculty of the university (curriculum, pedagogy, provision of faculty, admission of students). The HMO provides the video teleconference sites, teleconferencing equipment, broadcast technical support and operation of the teleconferencing network. Students receive IVT instruction at 10 locations throughout California, selected based on clustering of the students accepted into the program. The university faculty teach the IVT classes (approximately 60% of the total class sessions) one evening each week from the same remote-teleconference location throughout the semester. Internet-delivered class meetings (approximately 40% of the total class sessions) are conducted by the instructor and Areceived≅ by students from any location with an Internet-accessible computer.

Audio, video, and data interaction during the IVT classes are enabled through fully interactive, multipoint real-time video teleconferencing technology. The video teleconference bridge connection (via microwave and fiber optic network) allows the faculty to link all sites, or any two or more sites for multisite interactive group work, discussions, and for collaboration on course projects. Technical support for problem solving equipment malfunction is available by telephone from the teleconference technicians at the IVT network.

During the WWW/INT class sessions, the faculty and students interact electronically to receive assignments, conduct instructional sessions involving presentation of content, participate in online discussions, pose

questions and receive answers, and communicate about the course between instructional sessions. Students are also assigned learning tasks involving the WWW/INT between the weekly instructional sessions. Orientation to operation of the online aspects of the course is provided at the start of the semester. Technical assistance is provided by a Web specialist who developed tutorials to facilitate students= acquisition of WWW/INT skills and is available to students throughout the semester by e-mail. Communication between instructors and students, and among students, is facilitated by the use of bulletin board systems, e-mail, and telephone/voice mail. Students have access, via Internet, to the main campus library services and a reference librarian assigned as a designated resource for students enrolled in this program.

Subjects, Design, Variables, and Instrumentation

Participants of the study were a convenience sample of 44 registered nurses enrolled in a semester-long theory course in the first semester of the master=s degree program in nursing leadership and case management. Subjects were entered into the study through voluntary completion of the surveys (100% response rate). The final sample was reduced from 44 to 43 because of one unusable survey. The majority of participants are female (95%), Caucasian (65%), married or cohabitating (77%) adults who range in age from 30 to 59 years. More than half (56%) reported working more than 39 hours per week; 44% attended a college-credit course within the past year, 21% within one to three years, and over 18% have not been enrolled as a student for more than 11 years.

A correlational design was employed to examine the relationships among selected learner attributes, instructional variables, and the criterion of student satisfaction as measured by the Student Satisfaction Survey (SSS) instrument. The study examined eight predictors which included five learner attributes and three instructional variables (the facets of instructor/instruction, technology, course management). The five learner attribute predictors are: 1) previous experience with courses taught via technology; 2) self-ratings of competence with technology; 3) frequency of between-class usage of communications technology; 4) age; and 5) remote-site group size

The SSS, a 59-item, pencil and paper attitudinal assessment instrument, is comprised of an established questionnaire (Biner, 1993) plus survey questions appended by the researcher to collect data reflecting the unique technology combination of IVT and computer-mediated communications used for instruction in the course studied. Respondents indicate their perceived levels of satisfaction by marking a response on a five-point Likert-type rating scale (1 = very poor, 2 = poor, 3 = average, 4 = good, and 5 = very good). Multiple survey questions comprise each of the three instructional dimensions and generate a facet scale score. Four open-ended questions solicit students = narrative responses to aspects of the course. Other survey items generate general course and student information. The measure of student satisfaction is a composite of students= responses to two survey questions: overall satisfaction with the course, and comparison of the course with conventional classroom courses.

The survey was administered during a regularly scheduled video teleconference class at the conclusion of the course to all students enrolled who consented to participate (100%). Volunteers from each teleconference site distributed and returned the surveys to the researcher via postal mail. Two students absent on the evening of the data collection were sent surveys via postal mail and both returned surveys. Reliability coefficients were computed to identify questions for inclusion in the learner attribute and instruction predictor variables. Simple correlation coefficients (level of significance set at $p \leq .05$) were computed to discover the relationships (associations) between the eight predictor variables (five learner attributes and three instructional facet scores) and the measure of student satisfaction with the course (criterion variable). The results directed the computation of an intercorrelation matrix for the 17 survey questions within the facet of instructor/instruction to identify relationships among those items and course satisfaction. Linear regression analyses (forward stepwise) were used to determine the nature and closeness of the relationships among the predictors and the criterion variable, and among the 17 questions within instructor/instruction and student satisfaction. For the stepwise regressions, entry values were set at $p \leq .05$. Content analysis was performed on the students= responses to the open-ended questions to identify the frequency and commonalities of experiences with the course, students= likes and dislikes, and their suggestions for course improvements.

Results

The majority of students are satisfied or extremely satisfied with their experiences in the first semester of

a distance-education course (N=43, M=4.00, SD=.96). Of the eight predictor variables regressed on the measure of student satisfaction, only instructor/instruction contributes to explanation of the variance in course satisfaction scores ($R^2 = .21$). Within the facet of instructor/instruction, 8 of 17 questions are correlated positively with the criterion variable ($r > .40$, $p \leq .05$).

The data suggest the following pedagogical characteristics are associated with student satisfaction in a course taught by IVT and WWW/INT: 1) providing clear expectations about course assignments, 2) promptly recognizing and responding to students= questions, 3) encouraging student participation in class sessions, 4) using a variety of instructional techniques to help students gain a better understanding of course material, 5) establishing mechanisms for students to access the instructor outside of class sessions, and 6) providing timely feedback and return of students= written course work. The generalizability of the findings are limited to like populations due to small sample size and homogeneity. The high quality of the IVT technology used in the course may have minimized the impact of technology as a variable in students= satisfaction. Programs that use less sophisticated technology may find different results.

Discussion and Implications

Among the intercorrelations for the individual questions in the facet of instructor/instruction, 8 of 17 correlate with the criterion (satisfaction). Most important to students= favorable ratings of this facet are factors that support the critical need for interaction between and among students and the instructor. Four questions correlate positively and are statistically significant in support of this assertion: the promptness with which the instructor recognizes and responds to students= questions ($r = .50$, $p \leq .01$), the extent to which the instructor encourages class participation ($r = .39$, $p \leq .05$), the accessibility of the instructor outside of class ($r = .35$, $p \leq .05$), and the timeliness with which written work is graded and returned ($r = .33$, $p \leq .05$). These findings are no different that one would expect to find in a traditional classroom.

Students self-reported they had little or no previous experience with distance learning and rated their pre-course competence with technology as low, yet they were highly satisfied with the course. Their comments indicate they experienced frustrations over the unreliability of the Internet server (first six weeks) and with incompatibilities among individual computer software programs. The students overcame the technological barriers with the passage of time and through consultation with other students, the instructor, and the Web specialist. By the end of the semester-long course, 78% of students (n = 34) rated the course technology as good or very good. This is a remarkable finding in that students did not allow their initial difficult experiences related to the reliability of the technology to limit their use and acceptance of, and satisfaction with, course technology.

Students had choices about the type of communications technology they used, when they initiated communication, and with whom (instructor, adjunct faculty, other students). This choice is a key concept in the theory of transactional distance (Moore & Kearsley, 1996). The multiple modes of technology provide not only choice, but a variety of options for dialogue (interaction and communication) among participants in the course. Increased dialogue in an educational program reduces the perceived distance in the transactions of learning (Moore & Kearsley, 1996). The perception of reduced distance, increased dialogue, and student input to course structure may contribute to overall course satisfaction.

This study finds no association between course management and student satisfaction ($r = .08$, n.s.). Several course-design features may contribute to students= positive ratings of course management. The technology of the WWW/INT facilitates students= access to vast resources--both people and information--in a quick and convenient manner. This electronic access may explain why the majority of students rate access to library and resource materials as good to very good (67%, n = 29). The promptness of materials exchange among students and instructor is also rated as good to very good by 79% of students (n = 34). The multiple technologies (WWW/INT, BBS, e-mail) and the dedicated course Web page most likely contribute to this finding. Students can access the course syllabus, receive and submit all course assignments, and exchange written information electronically on-line at times and places that are convenient for them.

Technical support and training for participants in technology-mediated distance-education courses is critical to student satisfaction and program success (Boston, 1992). Students in this course received orientation and training in use of the various technologies (IVT, WWW/INT, BBS, e-mail) at the start of the semester. The availability of IVT technicians during class sessions and the Web specialist via e-mail contributed to high ratings for technology support in the course: 88% (n=38) rated the IVT support as good to very good; 72% (n = 31) rated support for the

WWW/INT component as good to very good. Students= ratings indicate that the provision of these support services are valued and most likely contributed to their positive ratings of course management.

Conclusion

When teachers use effective pedagogy, technology can facilitate interactive instruction and communication without compromising satisfaction with the instructor, instruction, or with the course. Overall course satisfaction is related to overall ratings of the instructor and instruction, regardless of course format, the physical separation of course participants, or technology=s mediation of communication and interaction. Satisfaction in distance-education courses is related to the performance of the instructor--just as for traditional face-to-face classes. Students acclimate to the instructional reality--traditional, campus-based face-to-face instruction or technology-mediated distance education--and once accustomed to that reality, it is the quality and effectiveness of the instructor and the instruction, not the technology that is associated with satisfaction.

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Students In Cyerspace: Tips For Successfully Navigating Your First Web-Based Course

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Abstract: This proposal is intended to present students with some tips for dispelling the understandable fears associated with research and statistics coursework undertaken via Internet. This proposal is intended to present students with some tips for dispelling these fears and for making the first-time Web-based student's instructional experience a maximally successful one. Drawing upon her nearly five years of experience in curricular design and instruction of graduate-based statistics and research courses online, the author has compiled a list of such strategies to share with novice Web-course students. These are subdivided into anticipatory, action and attitude strategies.

Introduction

Change is, by nature, inherently frightening as well as challenging. The recent change of increased Web-based instruction, coupled with the rather "fearsome" reputation of studying such subjects as research methods and statistics, can seem rather daunting to students.

Despite these understandable concerns, however, even the first-time Web student can have a maximally productive and minimally stressful experience with online coursework in research and statistics. This paper is intended to share some tips for students which are based upon the author's nearly five years of experience in curricular development and online instruction of Web-based research and statistics courses. These tips will be subdivided into three areas: anticipatory, action and attitude strategies. Careful planning and willingness to try these suggestions will help ensure an "A" experience with online research and statistics coursework for even the first-time Web-based student.

The Roadmap for Success in Online Learning

Figure 1 illustrates these three components of planning a successful online learning experience. It is based upon the author's extensive experience in developing learning materials for Internet-based instructional interaction (Dereshiwsky 1995; Dereshiwsky 1997).

Anticipatory Strategies

In life, as well as in cyberspace, good advance planning can make all the difference between success and failure. Following are a few tips for would-be novice Web students along these lines:

1. *Road-test your cyberskills beforehand.* As mentioned above, research and statistics material is inherently perceived as "tough stuff." They will require students' full concentration to master successfully. Adding the burden of learning basic computer skills on top of such content mastery is almost certain to lead to excessive frustration and stress. On the contrary, even first-time computer users can readily acquire the basic e-mail and Web navigation skills during the semester or break time in advance of their actual enrollment in a Web-based course. These basic skills include sending and

receiving e-mail; uploading and downloading file attachments; using a Web browser to navigate to a Web page; and clicking on embedded Web links. In most cases, just one or two appointments with a technical assistant at the university's computing lab facilities will be all that is needed to provide adequate opportunity for the computer novice to learn and practice these skills. Then, once the course actually begins, the student is not faced with the additional task of learning how to use a computer. Instead, he or she is freed up to concentrate instead on the actual content of the Web course.

2. *Checking out the playing field.* Most Web-based courses, including the author's own, already exist in the form of Web pages, hyperlinks, or as learning modules in electronic file format. Novice Web students may find it a great 'anxiety-reducer' to take an advance look at some existing Web courses and related materials. This will provide them with a rough idea of the nature of assignments; procedures for submission of work; due dates and time intervals for required course submissions; and additional information such as availability of interactive learning experiences with peers, access to instructor, and supplementary learning materials. Asking to see these materials—and most instructors will be more than amenable to sharing these in advance—often does much to 'demystify' the 'black box' nature of the curricular experience. However, a gentle caution is in order here: a handful of students who may already be unduly anxious about this coursework may discover that seeing the learning materials sometimes increases their feeling of panic. It is important to keep in mind that the course is designed to help you acquire this knowledge in a systematic manner, and with direct assistance from your instructor. You are not expected to come in with the knowledge that is encoded in these learning materials. This 'sneak peek' is simply intended to provide you with the road map of the learning odyssey—and *not* to imply instantaneously reaching that final destination.
3. *Meet and greet: getting the inside story from current and former Web course students*. Student grapevines regarding courses and instructors may play a particularly valuable role when it comes to 'getting the inside skinny' on what it's like to take an Internet course. Seek out current and recent Web course students and ask them to share their experiences, pro and con. What did they themselves expect to have in store prior to actually beginning a Web course? How did those initial expectations square with reality? Any surprises—both positive and negative? What did they do when they encountered problems with the course material? With computer access? How would they describe the instructor's communications skills? Accessibility? What is their opinion of the learning materials: Clear? Organized? Challenging? Or too difficult to navigate via one-on-one Web-based study? Finally, what specific advice would they offer you, a prospective first-time Web course student, based upon their own expectations and subsequent experiences? Students often feel freer and more comfortable asking candid questions and articulating their own concerns with other students, rather than with an instructor who is perceived as being in an 'evaluative' and/or 'supervisory' capacity. But here, again, a word of caution is in order. Make certain that you speak with a good representative sampling of such Web course 'alumni.' The danger in interviewing only one or two students is that you may inadvertently have selected an unrepresentative 'subject:' one, for instance, who entered the Web course without the prerequisite computing skills outlined in the preceding first point. It is almost inevitable that such a student will experience undue frustrations and difficulties with the course—difficulties which you can avoid by your own judicious advance planning. In addition, you should take care to speak with *current* and/or *recent* Web students who have completed coursework with the prospective instructor of record. Going too far back in time runs the risk that the information you will be given, even if candid, may be outdated: for one thing, many instructors (including the current author) periodically make major revisions in their curricular materials, interactive Web instructional procedures, or both. Talking with a good mix of students who are either currently studying with the instructor of record, or who have recently completed coursework with him/her (ideally not more than a semester old), would be your best bet for maximally credible and valid information.

Action Strategies

The semester is now in full swing and you have begun your first Web-based course. Even with astute advance planning, it is virtually impossible to anticipate all that can happen during the actual implementation of a Web course. Following are some "in-progress" steps you can take to help ensure smooth navigation of the information superhighway via your Internet-based coursework.

1. *Keeping those lines of communication open—and continually connected.* Nowhere is continual, direct, candid communication more vital between individual student and instructor than in the Web-based course. Some students, naturally accustomed to the periodic face-to-face group interaction that is the hallmark of the traditional classroom, can find themselves feeling a bit isolated in cyberspace. Likewise, your instructor, despite his/her best intentions in wanting to help you understand the material, will be lacking the verbal and visual signals that you might need help. One way to get around this potential stumbling block on the Internet superhighway is for you to resolve to maintain continual, direct, individual communication with your cyber course instructor periodically and throughout the duration of the course. One way to do this, for example, is to plan to send an e-mail message to your instructor at regular intervals—one a week, perhaps—briefly informing him/her: (1) what's *working well* for you; (2) what's *not working well*; and (3) any initial thoughts or suggestions you may have on *how to 'fix' what's not working*. In doing so, you are essentially forging a one-to-one partnership with your instructor. Rather than feeling 'lost in cyberspace,' you are capitalizing on the often-enviable opportunity to 'become a class of one' and have your instructor's undivided attention with respect to your progress and particular learning needs. This also helps your instructor to 'get a personal sense of you:' who you are, what you are all about, and in particular, to be able to work in positive partnership with you to vanquish minor problems and thus prevent them from turning into major roadblocks.
2. *Staying on track and on task.* Likewise, in contrast to the traditional classroom, nowhere is the potential for procrastination greater than in the cyber course environment. After all, you will not have the 'subtle pressure' and 'visual/verbal reminders' that a certain key due date for an assignment is fast approaching. Students enrolled for more than one course in a given semester sometimes find that it is all too tempting to 'let cyber coursework slide' while they instead attend to the obligations of the more traditional face-to-face cyber courses. This invariably leads to heightened stress, frustration and panic, particularly towards the end of the semester when reality hits hard and the pending uncompleted cyber assignments loom large as the clock ticks ever more loudly. This can be prevented by resolving, at the very outset of the semester, to treat cyber course obligations in *exactly the same way* as those of the face-to-face classroom. In other words, discipline yourself to set aside periodic blocks of time each week to focus solely on the learning modules, assignments, and instructor contact for your cyber course. This will help you meet your cyber assignment due dates with a minimum of stress and worry about falling behind. You might also get in the habit of sharing partial solutions, questions, concerns and similar communications with your instructor, perhaps via the vehicle of the periodic individual contacts in Point 1, above. This helps maintain your motivation and focus because you will be getting periodic feedback from your instructor on how you are doing on the upcoming work. Finally, if you anticipate being away from the keyboard for any reason—a work-related trip, for instance—be sure to inform your instructor and ask if you may either submit the assignment in advance (preferable, for your own peace of mind) or at a minimum, if you may have a *brief* extension of the due date for that particular assignment. All of the preceding will help you avoid the feeling of "semester's-end panic" that is caused by procrastination on Web-based coursework and assignments.
3. *"Having it both ways:" creating your own interactive study experience.* As mentioned above, a potential disadvantage of Internet-based instructional interaction, in the opinions of some, is the lack of direct, periodic face-to-face interaction. However, equivalent interactive opportunities for peer feedback can still be successfully incorporated by instructor and student alike. A few such ideas are listservs for students to periodically stay in contact via e-mail; newsgroups and similar 'student lounges in cyberspace' where notes and messages may be posted and responded to, bulletin-board style; and live interactive keyboard 'chat sessions' which essentially connect students in different locations but enrolled in the same Web course in 'real time' for interactive opportunities with their instructor and with one another. Find out if any or all of the above are part of the course expectations of the Web class in which you are interested. If not, you might suggest these to your instructor as voluntary out-of-class opportunities that you'd like to initiate: ask for advice and help along these lines. Finally, you can literally have the best of both instructional 'worlds' by seeking out other locally based students who are enrolled in the same cyber course as you are, for periodic face-to-face meetings and discussion of the course materials as well as sharing progress on related assignments. One prevalent feature of Web course recruitment is that it is particularly attractive to student cohort groups who may be located at a considerable physical distance from campus. This is true for Arizona, for instance, a state characterized by 'clusters' of geographically dense cities and towns. A regional Continuing Education office of your particular university will have information on other such student

colleagues who may be enrolled in the same cyber course and who live in close proximity to one another, even if they are located at a distance from the actual main campus. Think of this as a prime opportunity for you to 'network' and demonstrate leadership and initiative in forming interactive study teams in a social atmosphere of collegiality and true scholarly exchange.

Attitude Strategies

1. "Expect the best and get it." This popular maxim reminds us that how we perceive a situation often has a great deal to do with how satisfactorily it turns out. As pointed out in the introduction, many students traditionally approach the prospect of statistics and/or research coursework with considerable fear and trepidation. When computer use is added to the mix, the result can be resistance, insecurity and a feeling of panic at the first sign of difficulty. The following suggestions are offered in hopes of preventing these debilitating and needlessly self-sabotaging feelings for students of online coursework:
2. *"Slow and steady wins the race:" developing an attitude of positive persistence with regard to mastery of research and statistical concepts./* Students taking their first research and/or statistics course are often in for a bit of 'culture shock' regarding their study skills. While admittedly discouraged by nearly all professors, last minute massive 'cramming' study sessions sometimes do work for other subject areas. However, this is generally not the case for more challenging concepts such as those taught in research and statistics. It may take several in-depth re-readings of the course material, coupled with individual consultation with one's professor when questions arise, and perhaps even seeking out supplementary readings and/or tutorial help to reinforce one's understanding of these concepts. Such repeated and 'multi-pronged' study strategies may be new to some students. This is coupled with the admittedly understandable temptation to skim through learning modules which are posted as Web pages. In addition, keep in mind that Internet-based courses are popular with those students who work full-time and may have other commitments which make self-paced learning –with its avoidance of fixed, lengthy in-class commitments—attractive. All of these factors may conspire against the need to 'work at it' in terms of systematically and repeatedly, intensively studying the material. Students of research and statistics courses, particularly those taught online, must be patient with themselves and not get discouraged if deep understanding fails to result from a quick initial reading of the material. Instead, they must cultivate an attitude of patience and positive persistence, as well as perhaps re-examine their study skills in general.
3. *"We are not alone out there:" fighting feelings of isolation in cyberspace.* The preceding section identified procrastination as a dangerous potential trap for first-time Web students. Not having the 'gentle pressure' of the periodic, live, face-to-face meetings can result in a temptation to put off online-based commitments such as pending assignments. This danger is coupled with an often-pervasive feeling of isolation. It is natural to think one is facing a cold, impersonal computer screen, rather than a flesh-blood-and-spirit instructor, as one's learning source. This in turn can lead to feelings of isolation, loneliness, and a reluctance to 'reach out' and contact one's instructor with any questions, comments or concerns that may arise. The inevitable and sad results are heightened stress, frustration and a further fueling of procrastination. As mentioned above, prior awareness may hold at least part of the answer. Just knowing how the online instructional experience differs from that of the traditional classroom may be helpful. As with many other choices in life, there are inevitably tradeoffs. A plus of the face-to-face classroom for some students may indeed be the opportunity for periodic group interaction coupled with immediate reinforcement of one's questions, comments and concerns. This may be balanced by, for some students, the inconvenience and/or impracticality of having to commit blocks to time to attend class throughout the semester. This may be difficult for those living some distance from campus, as well as those with unpredictable work and/or family commitments. On the other hand, online instruction may be attractive to those who prefer to study intensively and at their own pace by themselves. Again, the tradeoff may lie in the lack of predictable group interaction, which is a negative for those with relatively strong social needs. Knowing one's preferred learning style, along with the relative tradeoffs of different instructional delivery methods such as face-to-face versus online, can perhaps help individual students become 'more informed consumers' who can better self-select into the particular instructional medium which best matches their personality and learning style. Two other helpful remedial measures for any lingering feelings of isolation have already been discussed in the immediately preceding subsection. These are: (1) maintaining direct and periodic,

candid contact with one's instructor; and (2) arranging for alternative methods of peer interaction in the online learning environment such as forming study groups with other locally based online students.

4. *"Cutting loose a little:" developing an attitude of adventure in cyberspace.* Technology, even as its avowed 'enemies' would readily admit, has developed at a fast and often furious pace. Changes in hardware and software happen virtually overnight. This often renders tried-and-true computer procedures obsolete, thereby forcing consumers of technology to re-educate themselves and change along with the techniques. The reams of existing change theory literature all point up the inherent scariness of change itself. Often something is furiously resisted, even if it turns out to be an eventual improvement, simply because it is different from what one is accustomed to. At the same time, one need only spend a few minutes in the company of children working on computers to recognize their spirit of joyful discovery and adventure. They seem to have an inherent sense of 'letting go of fear' where it comes to technology. Instead of automatically assuming the worst possible scenario, they happily plunge in and 'do'—with the invariable results of accomplishment and mastery. The author has observed the same phenomenon in many of her online students. Even those who admit to initial fear and hesitation later happily confess that "Once I got going, I soon realized that it wasn't as bad as I thought it would be! In fact, I surprised myself and did better on that (research/statistics assignment; computer procedure) than I thought I would." And lo and behold, fear is replaced by increased self confidence and a more playful, adventuresome spirit with regard to future course requirements! This attitude of 'suspending skepticism," coupled with a sincere willingness to "give it my best shot before I decide what I can or cannot do," may be the best antidote for the still-reluctant, fearful and/or resistant potential online student in research and statistics. The potential rewards to be gained in mastering challenges and feeling better about oneself and one's abilities, are simply too great to pass up.

Concluding Comments

"Well begun is half done." Yet another popular truism, this saying accurately reflects the value of some astute advance planning by prospective online students. "Doing one's homework" applies not only to the eventual online assignments themselves—but more importantly, to thoughtful consideration of anticipatory, action and attitudinal strategies that will help ensure a maximally successful and minimally stressful learning experience in cyberspace for even the first-timer.

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Training Mathematics and Physical Science Teachers via Interactive TV Transmissions and Computer Based Tutorials

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Abstract: In 1998 the University of Stellenbosch started to experiment with interactive TV transmissions – with direct audio feedback – as an exciting new medium of instruction. Transmissions to ten electronic classrooms at venues throughout South Africa involved students to whom such a learning experience in the past had been inaccessible. This paper reports on a project within which two series of 6 one-hour lessons each in Mathematics and Physical Science are offered to teachers via interactive TV transmissions and computer based tutorials. The teachers who participate are acquainted with material developed according to the envisaged outcomes of a new curriculum. It is expected of them to implement the material in their classrooms. In this way thousands of learners (of the age 16-17) will be given the opportunity to learn Mathematics and Physical Science as these subjects relate to their real-life experiences .

Introduction

In 1998 the University of Stellenbosch started to experiment with interactive TV transmissions – with direct audio feedback – as an exciting new medium of instruction. Transmissions to ten electronic classrooms at venues throughout South Africa involved students to whom such a learning experience in the past had been inaccessible. The experiment progressed rapidly to the point where accredited university courses are at present offered in this way.

This medium of instruction opens up new possibilities to address the enormous challenge of increasing the scientific literacy of the South African population. Improvement of the teaching and learning of Mathematics and Physical Science at school level is an obvious starting point. According to a survey by the Danish International Development Agency there are currently 8000 Mathematics teachers and 8200 Science teachers in South Africa who need to be targeted with in-service education (Smit, 1998).

The University of Stellenbosch offers in-service Further Diplomas in Education (FDEs) for Mathematics and Physical Science teachers in order to improve their subject knowledge and teaching skills. Instead of a mixed format of contact and distance tuition (the format used in the past), or pure "paper driven" distance education (the format introduced in 1998), we are planning to offer these FDEs by making use of interactive TV transmissions and computer based tutorials.

The first phase of this project will be implemented in the first half of 1999. Two series of 6 one-hour lessons each in Mathematics and Physical Science will be offered to teachers via interactive TV transmissions and computer based tutorials. The 100 teachers who participate will be acquainted with material developed according to the envisaged outcomes of a new curriculum (Curriculum 2005). They will

be expected to implement the material in their classrooms. In this way 3000 or more learners (of the age 16-17) will be given the opportunity to learn Mathematics and Physical Science as these subjects relate to their real-life experiences. An initial amount of 220 000 rand ($1 = 6 rand) was invested in this project – this boils down to a direct investment of 73.33 rand per learner. As soon as the courses are formal accredited learning programmes of the University, the normal funding mechanisms such as government subsidies and student fees come into play. This project will also have the long-term effect that many more teachers and learners in future will be given a learning opportunity which could brighten their future.

A Project to Address the Educational Crisis

Although there is a widespread recognition of the poor state of Mathematics and Physical Science teaching and learning in the majority of South African schools, the process of addressing this problem is only slowly starting to get underway. IMSTUS (Institute for Mathematics and Science Teaching of the University of Stellenbosch) addresses this problem, among others, by offering Further Diplomas in Education (FDEs) for under-qualified teachers. The customary mode in which these in-service courses were offered in the past, consisted of a blend of contact tuition (two periods of three weeks each per year) and distance education (assignments) during the rest of the year.

A widespread spirit of defeatism in school circles and the cancelling of all bursaries for FDE students (because of a lack of funding on the part of the Education Department) resulted in a drastic decline in the numbers of teachers enrolling for the FDEs. This despite the fact that a new curriculum (Curriculum 2005), with outcomes-based education as point of departure, is in the process of implementation and that all teachers are actually in need of renewal and upgrading.

In order to make FDEs more accessible and affordable to teachers, IMSTUS started in 1998 to offer the FDE in Mathematics as a full-fledged distance education course. In the process we have to draw upon the written medium of instruction as the only means of communication with the students. All our course material has to be restructured as "paper driven" distance learning modules.

In subjects such as Mathematics and Physical Science, however, an element of "live" communication between the lecturer and the students is of the utmost importance. The variety of learning styles of the students (teachers who follow the course and learners in the classroom) also have to be accommodated in the presentation of the course. Distance education via interactive television transmissions - with direct audio feedback - is a new mode of instruction which is currently being implemented at the University of Stellenbosch. We believe that the incorporation of this medium of instruction, backed up by computer-based tutorials, in the distance education courses may offer a very welcome and timely vehicle for more direct and live communication between lecturer and students.

The first phase of this project will be implemented in the first half of 1999. The main objectives of the project are to experiment with and explore the power of TV transmissions with audio feedback as a medium for the enhancement of Mathematics and Physical Science education; to improve teachers' subject knowledge and didactic skills in Mathematics and Physical Science; to utilize a variety of learning strategies of teachers and learners in the teaching process; to link Mathematics and Physical Science in the school curriculum to the real-life situations of the learners; to familiarize teachers and learners with the types of activities and outcomes envisaged in Curriculum 2005; and monitor the effectiveness of the process to the extent that it benefits the learner in the classroom.

We regard this as a pilot project which is offered on an experimental base in order to gain experience with and to evaluate the effectiveness of interactive TV as medium of instruction. We hope to gain enough expertise and experience though this pilot project to be in a position to make a real difference towards the upgrading of Mathematics and Physical Science teachers.

Description of the Project

A Mathematics and a Physical Science course, both consisting of six TV lessons of one hour each, will be presented to teachers of predominantly historically disadvantaged schools. The themes of these two courses are: "Functions and their graphs" (6 hours), "Astronomy (3 hours) and "Cement" (3 hours).

The format of each of these courses can be summarized as follows: Six TV lessons of one hour each will be presented to 50 Mathematics teachers and a similar series to 50 Physical Science teachers. Computer based tutorials will be used as aids in the presentation of the material. The medium of instruction will be English. Several activities will be included in these presentations to accommodate different learning styles and preferences of teachers and learners (Du Plessis 1998). Computer based models of teaching and learning will be utilized for this purpose. Learning materials were developed by IMSTUS for implementation in the school classrooms. The teachers will be familiarised with the material during the TV lessons. They will also receive didactic guidelines (with the aid of the models of teaching and learning) and are supposed to present the lessons to their grade 11 classes.

Preparation of the classroom material which is intended to accompany the TV lessons will entail the following: Material in the form of work sheets, exercises and stimulating activities will be developed for utilisation by the teachers in their own classrooms. Educational guidance and teaching resources such as transparencies will be made available to teachers. Learners will be requested to write tests compiled by IMSTUS. Copies of the computer based tutorials and of the computer based models of teaching and learning utilized by the TV presenter will also be distributed (on demand).

The course presenters will cooperate with the technical personnel in the studio and will incorporate video clippings, interactive multimedia tutorials, electronic transparencies, music (to enhance the learning process), computer based models of teaching and learning (Du Plessis & De Kock 1997), and activities to accommodate different learning and teaching strategies in their presentations.

The TV lessons will have much in common with ordinary lectures. It, however, also allows for certain special activities to be incorporated: Provision will be made for group work in the TV classroom; interaction between the presenter and students and among students themselves, even at other venues, will be encouraged; technical advice will be given to the participants on the effective utilisation of this medium of instruction; and didactic guidance will be given to the teachers on how to present the lessons to their learners.

The whole process are evaluated by IMSTUS, and teachers who successfully complete and implement the course according to predetermined guidelines will receive a certificate. It will be expected of teachers to reply to immediate feedback questions during the lessons. They will have to complete short questionnaires after each TV lesson and a final questionnaire on the course as a whole. Learners will be expected to write tests, compiled by IMSTUS. The results will be analyzed. IMSTUS will also conduct personal interviews with teachers and learners.

Venues

The University of Stellenbosch entered into a partnership with Logtek, a high technology company. They provide the satellite communication and the infrastructure in electronic classrooms at different venues throughout South Africa. There are currently 10 operational electronic classrooms in the more densely populated areas of the country and more classrooms will soon be added to the existing list. Each classroom is equipped, among others, with a TV receiver as well as a telephone connection between every individual student and the lecturer in order to provide for immediate response of students during transmissions.

Outcomes

By the end of June 1999 50 Mathematics and 50 Physical Science teachers will have been introduced to the teaching of their subject according to the outcomes of Curriculum 2005, 3000 learners will shortly thereafter have benefited from the opportunity to learn Mathematics and/or Physical Science as the subject relates to their real-life experience, and teachers trainers at IMSTUS will have gained expertise and experience in the teaching of their subject through interactive TV and interactive multimedia tutorials.

This project will lay the foundation for the further development and effective incorporation of interactive TV and multimedia tutorials in the presentation of the FDEs in Mathematics and Physical Science. In this way the FDE becomes more accessible and affordable. This project will also demonstrate how this effective and more affordable medium of instruction can be utilised to assist in accomplishing the gigantic task of advancing the scientific literacy of the South African population.

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A Modular Approach to Education – Its Application to the Global Campus

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Abstract: A range of pedagogic, administrative, socio-economic, structural and resource issues surround the establishment of a global campus. This paper identifies and discusses such issues, and suggests that pedagogic aspects are paramount. The limitations of conventional subject-based approaches are considered, and local experience in curriculum design and module integration is discussed in the context of flexible learning, wider access and participation. The need for a range of learner support mechanisms is indicated, and our implementation (together with others) is described. The concept of a global campus is underpinned by appropriate technological developments. Internet- and Web-based experience is discussed, as is the need for more radical approaches such as Virtual Reality techniques.

Introduction

The nature of higher education (H.E.) is changing globally: the convergence of wider access demands, greater emphasis on vocational preparation, new teaching and learning delivery mechanisms, and the emergence of globalised economies is propelling forward-looking H.E. institutions into careful self-analysis. At the same time, many countries (for example, U.K., Australia, U.S.) are witnessing a withdrawal from state-funding for both H.E. institutions and for student maintenance costs. With other but equally significant structural and resource difficulties, developing nations also share these problems (Koul, 1995)

As well as financial challenges, certain global trends are beginning to emerge. Valcke and Vuist (1995) describe experiences in the Netherlands that matches our local experience in the UK. Demographic changes mean that the profile of the traditional student is becoming older, often working or balancing the requirements of other family/career commitments: this implies a growing demand for increased part-time and more flexible learning provision. An increasing number of UK institutions have adopted a modular approach to course design and delivery – see, for example, George, Murfin, and White (1992). At the same time, there are many pressures for more effective teaching and learning delivery mechanisms. Active learning, student-centred and case-led methods are now accepted parts of the educator's canon (Rogers [1991]), and such changes have been growing in influence since the late 1980s. What is now emerging as a radically different and (potentially) revolutionary change is the use of Internet- and Web-based delivery channels.

Open Learning and emancipation

Before discussing such issues, it is worth recalling that one of the strengths of an open learning approach is what Reid (1995) refers to as an 'emancipatory tradition' - the barrier-dissolving aspects of such learning. Such emancipatory aspects are principally associated with learners previously denied access to education

and assume a much wider relevance within the context of a global campus. Reid (1995) directs our attention to 'structural constraints' relating to institutional, social, cultural, and political/economic factors. While the cost of commissioning and building new higher education institutions may stretch the financial resources of the developing countries, the ability to 'tap' in to such programmes of study offered via the Web may be of great emancipatory, as well as economic, potential.

This implies fundamental challenges for the future of higher education. Dolence (1995) suggests that these challenges stem from the use of an educational model developed from and for an industrial model of society. Is this appropriate in what Dolence calls an 'information model' of society? Is the cost model of such a paradigm still valid given the nature of such an "Information age"? Can the higher education sector ignore the potential of technologies such as Web-based 'push' technology, 'click-thru' mechanisms, video-conferencing, and virtual reality models?

In a wide-ranging survey of current thinking about pedagogical issues facing H.E. Diana Laurillard articulates the necessity of 'situation-learning' (Laurillard, 1993). Such learning implies that "the acquisition of inert concepts (e.g. algorithms, routines, decontextualised definitions - i.e. the stuff of many university courses) is of no use if the student cannot apply them...[We] have to use our knowledge in *authentic activity*, i.e. genuine application of the knowledge; this allows us to build an increasingly rich understanding of the tool itself and how it operates" (page 17). Here, the application of Virtual Reality models and techniques offers potential for implementation of 'authentic activity' and 'situated learning'.

Globalised education

The idea of a globalised higher education sector - a 'global campus' - implies administrative, pedagogic, operational, and technical issues, and the Virtual Online University (www.tcet.unt.edu) offers an interesting metaphor for the learning 'cyberspace'. It is structured around a virtual campus, designated as a 'MOO' (an Object-Oriented Multi-User Dimension), around which students can wander as they would around a physical campus. At the same time, the range of courses offered remains very traditionally 'subject-based'. Is this appropriate to such a new learning environment?

Such an environment may well present a lack of unified focus for learners. Laurillard (1993) draws attention to the decentralising effect of new technology. She argues that this can push forward a very fragmented view

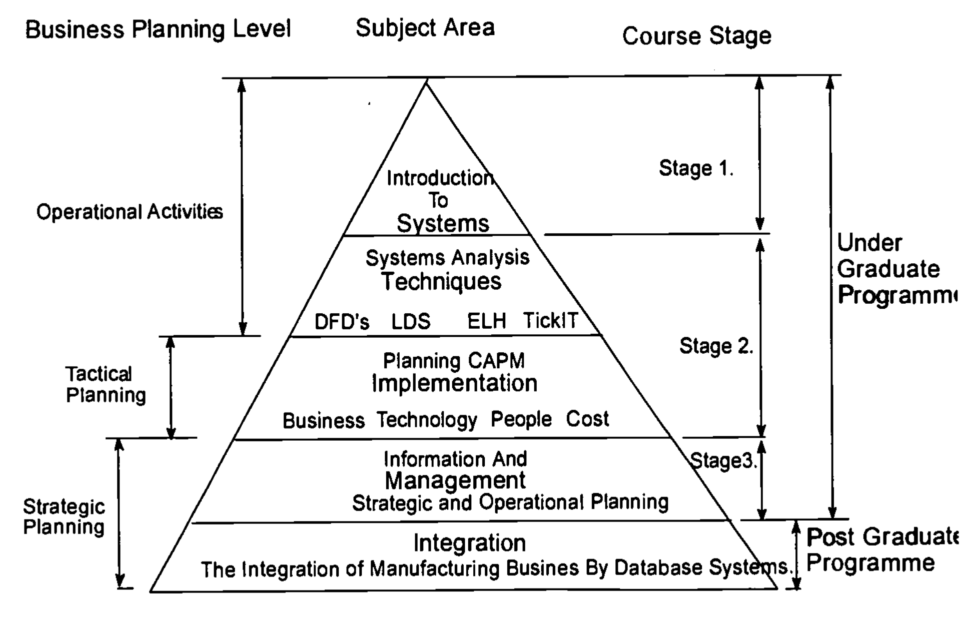

Figure 1: The STIMI Framework

of knowledge. This is opposed to, what she typifies as, 'academic knowledge', which has an integrative function different from simply 'knowledge'. It is this reflective aspect which is likely to prove difficult to deliver in the information model described by Dolence (1995). Learners in a virtual campus may well require a much stronger structural identity. It is, therefore, important that there is a strong conceptual platform that integrates and preserves a sense of intellectual and discipline consistency.

Local implementation

At a local level, we have attempted to incorporate such issues and challenges within a conceptual and pedagogic framework for the education of information engineers. A set of modules has been implemented within a conceptual framework entitled Systems, Techniques, Implementation, and Integration (STIMI). An outline of this is shown in figure 1 (The STIMI Progression). In stage 1, the concept of systems and systems thinking is introduced to students. This theme is elaborated in separate semesters in stage 2. The first emphasises the usual systems analysis techniques of process, data, and event modelling. Implementation within the context of Computer-Aided Production Management (CAPM) is combined in the second semester. By stage 3, management and management-information related issues are addressed by examination

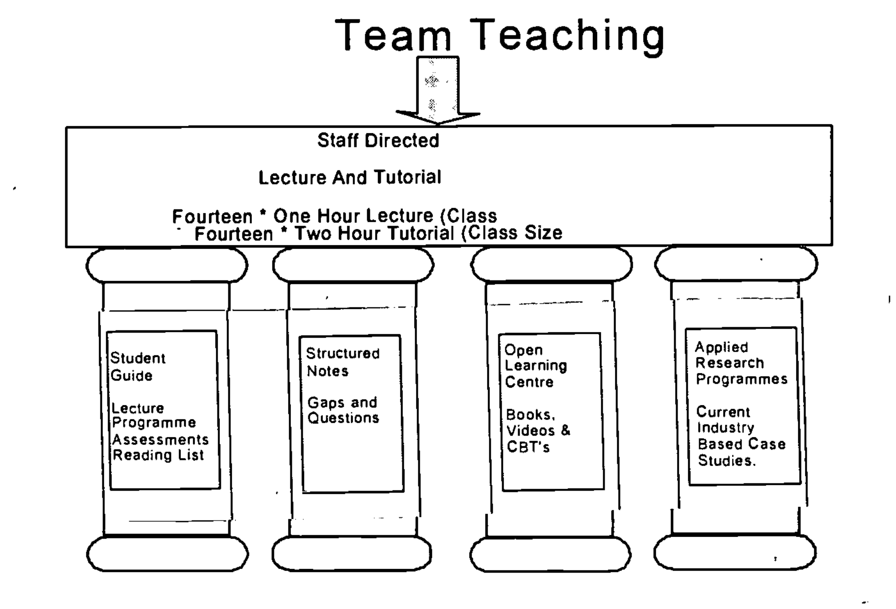

Figure 2: Support for module teaching

of strategic and operational planning aspects. The integration of 'islands of automation' within the context of manufacturing businesses is the prime concern of the postgraduate programme. This module is designed to enhance the learning experience of those continuing students who wish to pursue their studies at this level, together with providing a firm base for external students entering the programme from a wide range of industrial and educational backgrounds.

The basis of delivery for the modules is illustrated in figure 2 (Support for Module Teaching programmes). A body of structured teaching material (linked and sustained by four pillars that rest on the STIMI conceptual foundation) has been developed to minimise duplication of content and to provide a common platform for delivery. Following Race (1989), this incorporates a range of techniques developed from Open and Distance Learning models, such as self-assessment questions and other developmental questions and activities consolidated within the text.

The particular problems of part-time students, those students beginning their studies at differing entry points,

and students who require extra support are recognised, and are of especial relevance within the context of this paper. Such students have significant demands placed upon them by work and family pressures so such students can also access this material via the University web site. Open and distance learning material may appeal to university management because of its apparent cheapness, but such students are likely to require significant support mechanisms. They may be unfamiliar with the nature of independent learning implied by a higher education programme of study. How are such mechanisms to be implemented and managed given an electronic local campus, let alone a 'global campus'? Learner support in the global campus will rest upon two pre-requisites: learner support and technological delivery mechanisms. We will address the latter aspect later in this paper. For now, we wish to describe briefly some of the issues involved in supporting widely-dispersed learners. Such learners may well be dispersed temporally as well as geographically. The use of packaged material (CD-Rom, text-based and other resources) is the conventional means of handling knowledge content. But how can learners benefit from a shared learning experience? Romiszowski (1995) describes how a co-operative programme can be established, and can be extended by various Internet and Web-based technologies - bulletin-board conference facilities, email, links to resource materials (virtual museums, virtual libraries). All of these offer significant potential as an integrated collaborative platform.

Distributed learning

Such initiatives still, however, rest upon a traditional view of teaching and learning. The support of Distributed Learning paradigms should now be considered. Distributed learning is founded on the belief that the personal needs of the student are paramount. Academic institutions can evolve courses based upon modules (STIMI), that can expand choices for students whilst maintaining educational quality across location and time-bound constraints, as well as providing the student with a more self-paced, self directed, career-biased learning experience. A distributed learning environment can essentially be stand-alone with a single subject/operator or can be linked via with a common database and/or other systems into a distributed system/servers. The common database may either be held centrally (and modified if required by each system/server) or local copies can be used with changes highlighted to the other components of the system/network. For example, for a design engineer a distributed learning environment is desirable, but design engineers can be trained individually. For other learning contexts, it is mandatory, especially where teams of operators interact in command and control of resources. An example where a distributed environment would be mandatory is in Air Traffic Control where visualisation of air space needs to be accessed and controlled by many operatives.

Technological aspects

One of the potential problems with distributed learning is data transmission rates over networks. Optical Fibre technology has developed such that within the near future transmission rates of 10 Gigabits sec^{-1} will be possible over broad band optical networks (Chan, 1995). A current or near term technology is the so-called "DVD" CD-ROM (Bell, 1996) where data is written to a multiple layer CD. This technology gives the CD-ROM the capacity to store up to 17 Gigabytes on a single disc with a data rate capacity of 11 Megabits sec^{-1}.

Such technologies (given development) are of direct relevance to Distributed Learning and its application, by affording a platform for the development of such teaching aids as Virtual Reality (VR). Given the inherent ability of VR to display three or multi-dimensional properties of objects to a operator its uses in teaching and training are virtually endless. It must, however, be remembered that VR is essentially only a display tool and therefore cannot fully substitute for other forms of learning. It is also important, given the growing importance and development of VR technology, that VR itself should be taught as a module at core level (STIMI). Being a multi-disciplinary subject it can only be taught at a relatively high level. It should however become a mandatory subject in all information technology courses even if minimum time is devoted to it (Elson, Simms [1997]).

Table 1 below lists some potential applications for VR in teaching. This list is not meant to be complete and many other applications may occur to the reader.

Table 1: Some Uses of VR in education

Subject	Use
Physics	Motion, Orbital Mechanics, Gas Physics, Multi-dimensional analysis
Chemistry	Structure of compounds, molecules
Biology	Structure of organisms, behaviour of organisms
Earth Sciences	Earth observation, landscape
Geography	3-D structure
Geology	Structure of fossils
Engineering	CAD/CAM
General	Display and analysis of multi-dimensional data

For basic tutorial type work the basic technology already exists with PC's and CD-ROM's. For more extensive use lightweight cheap helmet-type displays need to be available along with the appropriate computer technology (fast networks delivering M-Bytes sec^{-1})

In conclusion then, the Global Campus is a rapidly developing field with many potential applications. It has direct application to teaching and training at many levels. Educators should be made aware of the capabilities and limitations of the technology. Distributed systems are required for its effective use. The concept of a Global Campus offers a useful metaphor for the delivery of a new mode of education, supported by fast and flexible delivery mechanisms.

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Tutoring Group Learning at a Distance

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Abstract: Experiences from a distance course conducted during 1996-97 and reports from other experiments have yielded the conclusion that collaborating via electronic conferencing systems demands new communication patterns.

Theories about: (1) communication, (2) group processes, and (3) shared symbolic order and social environment were used to help us understand what happened, how to solve problems, and how to take advantage of new possibilities.

A hypothesis was formulated about how to improve the efficiency in distance learning by introducing the participants to the special character of electronic conferencing systems communication and group processes. During the autumn term of 1998 we are conducting a field experiment that will test this hypothesis.

1. Experiences from a Distance Course

During 1996-97 a distance course was given for 51 high-school teachers about how to use the Internet pedagogically in their teaching at school. This was part of a governmental venture to find ways to support distance education in Sweden. The course ran during half a year and the participants studied part time, parallel with their ordinary full-time work as teachers. This was made possible through a course outline with only two 2-and-a-half day face-to-face meetings, one at the beginning and one at the end. In the meantime, participants communicated with each other and with the teachers through the electronic conferencing system FirstClass for asynchronous text communication. A fuller description of this course is found in [Männikkö & Fåhræus 1997].

The pedagogical model of Problem-Based Learning (PBL) was applied in a flexible way in the course. Ten task groups formed themselves dynamically during the first face-to-face meeting around themes that the participants found interesting. These task groups collaborated during the whole course via the conferencing system, using the system also for delivering reports, asking questions, and discussing general matters around the course.

We were two teachers tutoring five groups each. We tried to check the system for messages at least every other day. Thus we followed the progress of the group work. We avoided intervening in the group discussions and did not answer questions immediately, thus encouraging the participants to help each other. This was in line with the pedagogical model used: to encourage independence from us as tutors.

To collect and systematize experiences from the course we used mainly qualitative methods. The participants were to answer three questionaires, one before the course started, one in the middle, and one at the end of the course. They were asked to keep electronic diaries on their learning process. We collected all communication in the conferencing system and have analyzed part of the very rich material.

As teachers, we felt that this kind of course demands more preparation and more time to read all material produced, compared with a similar type of course, conducted in a traditional way. The fact that all that is "said" in the groups is written and visible to the tutor means that the tutor gets a good picture of the contribution to the group work by each and every participant. But it does not mean that the tutor can activate an inactive group. As earlier mentioned, we did not want to intervene if not necessary. That would have meant that we took the responsibility away from the group members. But when we found that a group did not start to work or that the work stopped, we thought we had to do something. We tried to encourage as soon as there was a sign of action, and we prodded by asking questions about their progress and so on. But still, we saw very little result of these efforts. Inactive groups still did not manage to complete the course assignments.

2. Some Results from the Communication Analysis

As an illustration, we will show examples below from the electronic records (in translation from Swedish) on which we base our conclusions. The material is excerpted from the conferencing system and illustrates the first month of communication in four of the task groups. The size of the groups were three to five people. Three of the groups were quite active, posting between 24 and 52 contributions during the studied period, whereas one group was rather inactive with only 12 contributions. Four people from these groups left for different reasons the course after one or two months. The rest passed the course, but members in the active groups got higher degrees. More about this material is found in [Fåhræus & Männikkö 1998].

2.1 Action and Reaction Affecting Group Cohesion

We will here give some examples of different action/reaction behaviours that seem to aim at group cohesion. Most messages have an opening and an ending consisting of a *greeting* addressed to the whole group.

Greeting: Hi, everybody!
Greeting: See you!

Sometimes the response greeting addresses a certain person.

Greeting: Hi, Tom, I got your mail!

When a *question* is raised, it is obvious to the recipients that an answer is expected, and they react accordingly.

Question: Is this the most intelligent way of talking?
Answer: There ought to be better ways!

A contribution can be answered with a *question*.

Contribution: Here is the re-written version.
Response: How about adding a reference to the homepage?

But also when a member is suggesting something or contributing in other ways, there is an expectation of some kind of *feedback*, and the feedback can also function as a confirmation of a received message.

Statement: I really hope the file will arrive correctly now.
Response: I've got your file and read it.

Sometimes a statement is an indirect *plea for help*.

Statement: I still don't manage to open files.
Offer of help: When I highlight the attachment and then click Open, I can choose Save.

A statement can also be a *request of response*.

Statement: I think we need to discuss this further.

... or a *promise*.

Statement: I'll try to fix this during the weekend.

Often one person gives a contribution and someone else gives an encouraging *comment*.

Contribution: I've written and sent this text.

Comment: Your text is good.

The communication can also start with an encouraging comment.

Comment: Hello, Tom, great that you put up a homepage!
Response: I did my best.

The respondent often *agrees or disagrees* with the contributor.

Contribution: Not very much result from searching the Net.
Agreement: I've also had problems in finding good material.

The groups differ a lot in what degree members reacted on action from the others in the asynchronous communication. The three active groups in the sample reacted to one half to one third of the cases. Typically, there were one or two active persons in each group giving most of the feedback. Members in the less active group was reacting only to every eighth action.

2.2 Communicating Different Contexts

Characteristic of the communication at a distance is that people are situated in different contexts. The technical environment they work in, their learning situations, social situations, and professional situations vary. Being in different contexts make people place different demands and this can impede contact and make it difficult to understand each other. Therefore, communicating the context can be a means of reaching each other. This is used in the active groups where the members now and then kept telling each other about problems and delights in their everyday life.

About the *professional* context,

Message: I think I mentioned my other project. It's about studying German.

.. and the *social* context

Message: I just came home from a meeting about violence in the neighbourhood.
Response: It really is awful with all this violence. How does it look like where you live?

.. and *technical* context

Message: I got some help from my school and now the system is installed.

In some cases we believe that complaints about technical problems were also messages about higher-level processe and could be called *process-context* messages.

Message: To be a computer user is not easy. It ought to be!

2.3 Synchronous Communication

"On-line chat and even MUD became popular. Several of the task groups established regular chat hours for meetings. This was a way to speed up the decision making process in the task group and also to create effective working routines for the group." [Männikkö & Fåhræus 1998] (P. 675). Especially one group developed an efficient pattern in their chats. At the beginning, the discussion was rather chaotic and mostly dealing with practical things and greetings. Eventually they developed a pattern, giving short messages, mostly about who should do what and when. They even managed to handle parallel threads which you can see in the third chat. Sometimes one person gives two messages after each other concerning different themes, without waiting for a response.

From the first chat:

- - -
Linda: I write to see if it works.
Robert: Hi, everybody!
John: This was a good idea!
George: It seems to work!
Linda: This maybe works.
George: Where did you find this function?
- - -

From the second chat:
- - -
Anne: Nice to be with you from the beginning this time! My question is what to do with the suggested homepage.
Robert: If you attach it here I will publish it. Otherwise you can try to follow my instructions.
George: If I understand right Robert has written instructions about how to do.
Anne: I can send in via FirstClass? Or via email?
George: Try ftp!
- - -

From the third chat:
- - -
Robert: What happened to Jack?
Robert: I will copy this conversation.
John: It seems as if Jack quitted.
Robert: I'll ask Tina to take away his access rights in this conference.
John: Does copying mean pasting in a Word document?
John: Did we agree about file format for our text?
Robert: Copying means saving the conversation in our conference. I copy and send via email.
Robert: Word I suggest.
John: Me too (haven't got WP at home)!
- - -

3. Findings about Communication Patterns

There are many conclusions to be drawn from this course and the material collected. In this work, the focus is on one factor: the communication patterns in learning groups.

The analysis of the group communication has shown that the communication patterns were different in the groups. Participants in successful groups gave each other frequent feedback and kept in contact several times a week. Less successful groups communicated either very seldom or in a more individualistic way: One person wrote a contribution; after a while there might be a contribution from someone else but without reference to the former.

The patterns people have developed for face-to-face communication are of little use when communicating only via text in an electronic conferencing system. They may even hinder. The spontaneous and fast feedback we get from face expressions and gestures are not at hand. People try to transfer these to the new medium, e.g. as greetings and smileys. They have, however, to be supplemented by other means. Not all students understand this and, if they do, it might take some time for them to "invent" an effective communication pattern.

The lack of spontaneous feedback is not the only difference between face-to-face communication and via an electronic conferencing system. The time lag and the conservation of the written words are other factors that induce new communication patterns.

4. Theories that May Help Us Understand

4.1 Communication Theory

With a humanistic perspective we regard communication as a tool to construct meanings. When we interact face to face, we use a broad repertoire of signals; and interlocutors impact on each other's behaviour on many levels. "Countless generations have enabled us to respond promptly (and generally quite accurately) to the affordances offered, say, by a ripe apricot, a girl's smile, or a seat in the shade on a hot day" [Mantovani 1996]. Using technical media for this interaction narrows the repertoire. We need new models to interpret this new environment.

In order to deal with their assignments in due time, the task groups of our course had to start an effective communication in one or two months. This is a short period to develop a new pattern of communication. Some of the participants had some practice of electronic communication when the course started and there is reason to believe that those helped the others. Participants in successful groups gave each other frequent feedback and referred to other's contributions.

4.2. Group Processes

Groups collaborating with a common task usually pass through similar stages. Five stages can be described in the following manner [Wendelheim 1997] (Pp. 16-17):

- *The initial stage* is focused on issues of *membership*. This is when group members try to find out how to behave in the group in order to be accepted by other group members and by a leader. The interaction is tentative and polite. There is much ambiguity and anxiety about goals and procedure. "Thus, of primary importance during this stage are the individual members' inclusion needs."
- *The second stage* is reached when the group is faced with issues that require distribution of *influence* among group members. Conflicts can arise when interpersonal dominance and competition are handled. According to the theories, these early conflicts are important for the group to develop stability, openness, trust, and cohesiveness.
- *The third stage* can be characterised as a period of *openness*, integration, and trust. Members exchange feedback, ideas, opinions, and feelings and maintain an appropriate balance between concern for task performance and relationships among members.
- *The fourth stage* is when *task performance* is in focus. When the group has reached this stage it has the capacity to function fully as a cohesive work group, committed to the task.
- *The fifth stage* is the final one when roles and tasks are *terminated.*

There were signs in our material that the active groups had passed the first two stages during the first face-to-face meeting. This means that they entered the distant phase with open minds and as rather integrated groups. After a short planning process they started to work with their tasks. The less active group was still mainly struggling with questions about membership and influence [Fåhræus & Männikkö 1998].

4.3. Shared Symbolic Order and Social Environment

"Symbolic order, if it is not shared, cannot ensure the intelligibility and reciprocity of actors' conduct. Conversely, when symbolic order not only functions properly but is also enhanced in its role as map of social and physical environments, communication and cooperation among actors are greatly facilitated" [Mantovani 1996] (P. 55).

If members of a group belong to the same culture and use the same symbolic frame, they usually manage to interpret each other's messages. [Mantovani 1996]. But different symbolic orders can lead to problems.

The meaning of the conferencing system as a place for collaboration and communication was not quite obvious and self-evident to the participants in our course. It had to be negotiated and exemplified through the behaviour of the members [Harrison & Dourish 1996] [Männikkö & Fåhræus 1997].

5. Conclusions about Efficient Communication

1. Collaborating via electronic conferencing systems demands new communication patterns.

2. When collaborating via electronic conferencing systems for the first time, most students do not use an efficient communication pattern.
3. Until it has passed the stages 1, 2 and 3 in the described model a group does usually not collaborate efficiently.
4. Students are seldom aware of stages in group processes.
5. There ought be a means to help students to learn a communication pattern that works in electronic conferencing systems and to take advantage of the group process.

The following hypothesis is formulated:

One can improve the efficiency in distance learning by introducing the participants to the special character of electronic conferencing systems communication and group processes. Such an introduction ought to be based on the students' experiences and actions.

6. Field Experiment to Test the Hypothesis about Introduction

During the autumn of 1998 a field experiment was conducted to test the hypothesis about an introduction. This was done for a distance course called "People, computers, and community", which is using an electronic conferencing system as communication medium.

At the beginning of the course, 50% of the students were offered a three hours' introduction about how to communicate electronically. Participants were divided into groups of three. One was a sender, the second participant was a receiver and the third one was an observer. Each of them got secret instructions. The sender was supposed to try to get the receiver interested in joining a club. The receiver should play a role: Either "the interested listener", "the sceptical", or "the uninterested receiver of the information". The objective of this excercise was to let the paricipants experience how difficult it is to communicate, if you do not give and get feedback.

After the excercise, we had time for reflection and discussion with all the participants about the means of giving feedback in an electronic conferencing system and the consequences of that. We also discussed group processes, and how they might influence the work in the task groups, communicating at a distance.

The students were asked to answer questionnaires about how they have experienced their own and their peer students' communication. The communication in the task groups was saved electronically and will be analyzed in 1999 in order to find out what effect the introduction had, if any.

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Science: Out of This World Goes Online

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Abstract: *Science: Out of this World*, an awarding winning middle school science TV series gets a World Wide Web makeover and new directions. This paper discusses the conversion of a science video course (grade 6-8) to Web enrichment units supporting standards-based instruction in math and science as well as interdisciplinary extensions. Topics include the planning and research that went into the move, project programming, server and development equipment, the features of the Web version, projects benefits, teacher inservice, project status, and proposed additions.

Introduction

For four years, the Space Science Group at Northwestern State University offered *Science: Out of This World* via live satellite TV and video tape. This middle school distance learning course has won numerous awards including first place winner in the Education: Science category at the New York Festivals for International Non-Broadcast Media for two consecutive years and two bronze medals in the Telly awards.

The Space Science Group has now completed the pilot year of the first Web unit and added a second unit. The final version of both units came on-line in the fall of 1998 and immediately received Web excellence in education awards. Schools can now register to participate in the program.

Project Planning

As satellite costs continued to climb and the number of Internet connected schools expanded, the Project Coordinator, Mike Hawkins, initiated a feasibility study to explore the potential use of the Internet as an alternative delivery vehicle. Team findings concluded that a substantial amount of current research points to the importance of the use of hyperlinks in developing a dynamic learning environment. This lead to further redesign and a move away from the original linear video concept of a complete scope and sequenced course. The prototype for the Web-based version emerged, resulting in new non-linear, dynamically linked, theme-based enrichment modules incorporating information on a variety of science disciplines. Active Server Page , ASP programming, was selected as the authoring system which best provided the data handling required for this massive effort. The basic science content is integrated by its application with one or more themes. This structure allows teachers the flexibility to teach science the way research suggests it should be taught, linked to real world applications.

Project Development

The content of a single unit, "Life in the Fast Lane," was selected for initial conversion. The content of this unit, which comprised 18 individual lessons, was reorganized into five major themes. Space topics were listed in outline form under each theme.

Simultaneously, the science content of the unit was divided into basic, stand-alone topics called instructional units. Science topics that incorporated more than one instructional unit were called synthesis or summary units. These were linked to the appropriate instructional units.

Links were then established between the space themes and topics, and the science summary, synthesis, and instructional units. The result was a collection of outlines linked by arrows that show the flow of information as one surfs the content of the site. This could be described as a top/bottom—bottom/top procedure which eventually meets in the middle, establishing links between motivational space and basic science content.

As the unit was converted, additional science content has been inserted. Plans are to continue the process until all six units of the video course are on the Web. As each unit is converted, additional science content will be incorporated. By the completion of this conversion, the site should include all the science content covered during the middle school years.

Special Features

Features of the site include:

1. E-mail updates to the teacher
2. Separate bulletin board and chat rooms for teachers and students
3. Streaming audio and video
4. Special NASA e-mail guests to answer student questions
5. Educational games and online activities for students
6. Over 170 lab activities using common lab and household supplies
7. Quizzes and self evaluation activities
8. Posting of student work and news about how schools are using the units
9. Links to supplemental activities and resources
10. Optional custom designed lessons and lesson plan bank
11. Home access for students and teachers
12. On-line and phone help

Implementation

The site may be used by schools with varying access to computer equipment. For schools with entire labs connected to the Web, students can access the page and complete interactive lessons. In classrooms with one computer and a suitable display, the interactive lesson can be completed together. In classrooms without direct web access, the teacher can use material downloaded during planning time to supplement lessons.

The material available on the site can be used daily, weekly, or in any way that fits the needs of the individual school. The material can be used by teachers in any subject area and is available to all students. This makes the page ideal for interdisciplinary instruction and projects. It can even be used by students at home if they have web access. Teachers can design entire lessons or blocks of lessons from this material or use small portions of the page to enhance lessons with real life applications of science.

Benefits

Participation in the *Science: Out of This World Wide Web* offers a variety of benefits to participating teachers, students, and schools. Students learn basic science principles supporting the national curriculum standards for middle school students. Additionally, the space theme of the interdisciplinary activities is motivational in the following ways:

1. It helps students to think about their futures and the importance of understanding math and science.
2. It shows how science impacts our everyday lives in ways we never notice.
3. It gives students the opportunity to use current technologies and develop skills that will be necessary in future job markets.
4. It enables students to interact with scientists and students from other parts of the country.
5. It builds group problem solving skills and teaches teamwork through the completion of hands-on, cooperative lab activities.

Teachers find themselves motivated as well.

1. They get valuable practice in using new technologies.
2. They get to interact with other teachers, finding out what has worked and not worked for them.
3. They have access to an enormous database of material and people to support their instruction.
4. They are able to find new ways to make instruction fun and meaningful.
5. They are motivated to go beyond the basic requirements of presenting information and are given the opportunity to develop state of the art lessons that give their students a real advantage in the 21st century job market.

Schools benefit as teachers and students apply the learned skills to other classes.

Many schools have reached the first step. They have computers and they have Internet connections. Now they need to know how to use this technology. Participation in *Science: Out of This World Wide Web* is both a meaningful use of technology and a training opportunity for the future.

Continuing Development

The project staff is currently working with the Educational Technology instructional design and multimedia classes to develop an on-line workshop to provide orientation and training for the classroom teacher. This in-progress addition to the program will replace the site-based training conducted for the video and early Web version of the project as well as providing an exciting opportunity for program graduate students.

Currently, a second theme has been completed and two additional themes have been selected for conversion to the site in the coming year. Each theme will link to the appropriate content area and supporting standards thus developing a truly multidisciplinary site with greater subject depth and flexibility. In the same way, the recently added lesson plan upload feature will allow teachers to contribute to a bank of field tested classroom activities, further expanding the project.

Further, as the project grows, so do the equipment support requirements. The original server, 200 Mhz Compaq with 12 Gb storage, will become a development station with the delivery of a 400 Mhz Dell 4200 with quad processors and 5 drive RAID array of 9.1 Gb hard drives as the new Web server.

Getting on Board

Finally, session participants will be given a tour of the site, a sample lesson, a look at new features, and the opportunity for Colleges of Education to enroll for a free site license. The school-based site fee is currently $100, with subscription information available by contacting Mike Hawkins at 1-800-259-9555 or hawkins@nsula.edu. One can also register online at http://www.nsula.edu/departments/space-science.

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Approaching Distance Learning to Classroom Activities. A Faculty Updating Program to Meet this Goal

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Abstract: This paper reports the experience of constructing university teachers updating programs, generated by the needs of renewing educational strategies. Such updating programs aim at conjugating technical knowledge and programs manipulation to the new work strategies by exploiting presence environment and WWW environment.

The goal is to renew, gradually, didactic performances of the teacher, combining possibilities of classroom learning with distance learning possibilities. We intend to improve the direct relationship with the student whom, on the contrary of most teachers, already have good experience in handling with technology, but must take qualitative advantage of the researches within the university course being taken.

Introduction

Practical actions directed to updating faculty working for Universidade Anhembi Morumbi have as their main goal to look for creative educational solutions to exploit Internet informational, communicative and research resources to improve classroom and distance learning quality. In order to do so, we had to invest in faculty updating programs as well as in faculty continuous assistance programs.

The aim is not only creating technical conditions, offer computer equipment, network connection and laboratory restructuring, but also create intellectual conditions to enlarge teacher's role through the use of new technologies applied to teaching and learning. Thus, we have structured a program containing courses, workshops, virtual teacher guidelines and assistance to doubts.

We are a young university, distinguished by the fast absorption of new educational trends and formation aiming both at the creation of new courses to form professionals capable of complying with the needs of the new work market, and at the development and updating of our faculty members to enable them to react and implement vanguard educational solutions.

Human resources, i.e., teacher updated formation, is a constant obstacle to programs aiming at implementing educational vanguard actions, which implies in development of curricula proper to the market, generation of different possibilities and format of courses, proper and rational use of teaching technology, among others. Thus, at the same time we try to develop new courses, new educational attitudes, we also have to create conditions to develop faculty members without interrupting their teaching activities.

Two years ago, we created the Act Online project (Garcia, M & Maia, C, 1998 – a), which has two main objectives:

- Offer courses of recognized classroom acceptance in on-line format, aiming at reaching the public outside university campus. These are short-term courses, which last three months in average, for continuous professional upgrading purposes. Nowadays we are on the fourth edition of these courses, working together with an interdisciplinary production team (Garcia, M & Maia, 1998 – b).

- Create technological and didactical conditions to enable our professors to take effective part in the development of projects.

Such purpose comprises:

- Stimulate faculty to create educational projects exploiting Internet resources
- Enable transfer of different information in the form of courses and interactive repository available at WWW, in which information searched is driven through activities started in the classroom;
- Research pedagogic effects of instructional interface for WWW in activities of this category.

After this period, the second goal became more comprehensive in order to support the first one, regarding on-line courses offers.

At present, the creation of technological conditions enables:

- Launching of different on-line courses and other category of courses: graduation and refresher courses;
- Create in Internet WWW environment a path between classroom activities and distant access to different contents and activities of a certain subject
- Launch a virtual professor guide
- Offer technological and didactic updating workshop

This article proposes to report on last item.

Creation of technical and didactic conditions for the teacher

The creation of technical and didactic conditions for the teacher comprise the following steps:

- Faculty updating program in service, comprising courses and workshops
- Virtual class guideline
- Creation of WWW environment for distant courses
- Knowledge creation banks

Faculty updating program and its steps

University Anhembi Morumbi faculty-updating program has been created in order to assure that projects aiming at improving educational strategies quality through the use of new information and communication technologies would be implemented.

Initially, our goal is to get a teacher who has good performance in classroom, take advantage of his/her motivation and didactic experience, and start the first attempts of technological and didactic updating.

1. Program Phase:

How to use Microsoft Office resources to improve class. At this phase we emphasize the use of Word to create handouts, exercises and tests, the use of Power Point to create presentations, as well as basic notions of hardware. In Brazil, most microcomputer users use PC with Microsoft Office Programs, thus we made an option to build workshops based on knowledge and handling of this software.

2. Program Phase:

Deeper research notions, as well as exploitation of Internet communication resources. Basic principles to create html pages, which can be proposed in an educational site. This step comprised 24 hours of classroom work. Performed in July/1998, it reached 60 faculty members.

3. Program Phase:

How to create Web-activities and on-line courses. The course aims at preparing teachers to use Internet and produce classes, didactic contents, and activities for WWW environment. The course consists in three Workshops, each one of them working on a theme. Started in October/1998, it intends to reach 60 faculty members.

First Workshop, theme: computer mediated teaching and learning
Second Workshop, theme: course structure and on-line activities
Third Workshop, theme: tools to create on-line courses

Course Content:

First Workshop – theme: Computer Mediated Teaching and Learning

- Differences in teaching in the classroom and at distance
- Why WEB courses
- WBI (Web Based Instruction)
- Virtual teacher, virtual student and virtual content role;
- Concepts to make a Web page
- Difference between institutional site and site for educational purposes

Second Workshop, theme: course structure an on-line activities

- Content distribution notions;
- Exploiting hypermedia and hypertext;
- How teachers can exploit and create new didactic solutions for the WWW
- Interactive activities for motivation and evaluation

Third Workshop, theme: tools to create on-line course

- Basic ingredients to assemble a course
- Basic assembly of a mini-course in the WEB
- Courseware main tools
- How to use the tools
- Results
- Submitting proposals for distance learning courses

Guidelines for virtual class construction

Teacher guideline aims at:

- Deepening contents worked in different courses and workshops offered in the classroom
- Instruct faculty on how to exploit WWW resources
- Internet designs for educational purposes
- Instruct faculty on how to create activities in WWW environment
- Instruct faculty on how to insert its students works in WWW
- Instruct on content distribution in hyperlinks
- List of main educational sites
- Glossary of terms used in Internet/WWW.
  This guide is given to all teachers who take part in the program.

Creation of WWW environment for distant learning courses

It has been created a WWW environment for distant learning courses, which contain the main resources and tools to enable the teacher to become an author of on-line courses. This virtual space

has its instructional interface in the form of frames and menus, which must be filled out with content given by the teacher. Some of the elements it contains are the following:

- Course modules content
- Hot-links
- Debate forum themes
- Case studies
- Interactive exercises and activities
- Messages calendar
- FAQ's

We made an option not to use specific course for this environment to construct the courses. We'd rather design the course according to its specific needs. The whole work of building pages used the following softwares: "Macromedia Dream Weaver", "Macromedia Flash", "Home Site" and "Photo Shop". Access tools to the content have been created in order to render easier the interaction of student with content, with their facilitators and also with other participants. The project incorporates the use of tools for self-learning mixing individual research and cooperative research, individual activities and cooperative activities. There are four categories:

- Learning tools: guided visit, reading, glossary and help regarding content
- Interaction tools: e-mail, discussion list, classroom
- Research tools: hot-links (selection and special links)

Knowledge bank creation

Knowledge bank must offer Universidade Anhembi Morumbi student direct access to a series of important information, such as:

- Courses and subjects amendments
- Student grades position
- Hot-links research – selection of links about the course
- Web-bibliography
- Students home-pages bank
- Integrated works bank – interdisciplinary works developed by students
- Class reinforcement – review exercises

Through this knowledge bank it is intended to create a space in the university institutional site, from which the student, through personal password, can access data and information related to his/her academic situation and also regarding content and reference of his/her course.

Final Comments

Our goal is to check how faculty updating programs can be developed and implemented, aiming at general and specific goals and how to maintain and follow-up the teacher to help him/her achieve effective results in the classroom, creating conditions not only for technological updating but also for didactic and qualitative exploitation of WWW/Internet for classroom work. This is an attempt to broaden the concept of distance education in WWW/Internet environment aimed at classroom work.

It is important to highlight that all this work demands the involvement of different departments and a new form of dialog and interaction between them. The teacher involved has demonstrated different levels of interest and involvement to the program. The biggest problem we have is to conciliate classroom work time with time to prepare all the contents involved in the program, besides the hours of participation in classroom workshops. The option chosen was to offer workshops at weekends and also designate technical consultants to give support to the teachers involved.

We also face the difficult of extending the number of computers available to teachers and students in the two campuses of the university, both in the classroom and in the labs. Gradually, we are renewing and increasing the number of computers connected to Internet.

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The Perplexing Problem of Teaching a Graduate Education Course via the Internet

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Abstract: The purpose of this study was to identify the perceptions of a college instructor redesigning a graduate course in educational philosophy for distance learning. Since the traditional class was taught through lecture and group discussion, the challenge was to provide the content and discussion in a suitable format. The instructor assigned textbook readings and provided lecture notes written in an entertaining manner. Group discussions were handled by having students post their responses to questions and react to the responses of assigned group members. The deep level of the content required constant monitoring by the instructor. Based on this experience, courses must be designed to provide interaction and immediate feedback to the students. This requires working with smaller numbers of students and having the tools and training available to develop interactive multimedia lessons.

Perspective

Distance learning is fast becoming an alternative for adults who want to initiate or complete a college degree. One of the major concerns of distance learning is student attrition (Kember, 1989). Students often register thinking they can stay at home and complete the coursework. Family demands may cut down their expected time of study and force them to spend late hours on the computer. This coupled with working in isolation and lack of contact with other students and the instructor may add to their frustration.

The Web has been shown to be "a viable means to increase access to education" (Owston, 1997, p. 29), although it is unclear whether it can promote an improvement in learning (Clark, 1994; Kozma, 1994). It does provide more flexibility for the adult learner. Owen (1993) states that a higher quality of interaction and learning may be taking place due to the increased time a student has to reflect before posting his responses. Thus, the present study was initiated to identify factors that promote learning and interaction in a graduate distance learning course from the perspective of a college instructor. This information should help in the development of a sound delivery system to promote distance learning at the college level.

Objectives

This study is part of a larger, multiple perspective study on issues related to distance learning. The present study was developed to identify the perceptions of a college instructor redesigning a graduate course for distance learning. Since the course was taught through lecture and group discussion, the challenge was to keep the flavor of the course without the real time interaction. Identification of the problems involved in changing formats of a course is a necessary prerequisite to developing sound instruction to meet the needs of a growing population of adult learners.

The Study

A graduate level educational philosophy course was designed for distance learning via the internet. First, it was taught primarily via e-mail then in web-based programs. The content of the course was provided in the form of

lecture notes with assigned questions to promote discussion on issues. Responses to the questions were posted in a web-based program. Students were then instructed to post comments to their assigned group members. In addition, students kept weekly journals of their learning experiences and developed a research paper on their philosophical position.

The female instructor of the course had twenty years of teaching experience at the secondary and post-secondary levels. She has spent the past four years designing and redesigning two graduate level courses for delivery totally by the Internet. The instructor has made reflective journal entries. The journal entries included expectations, challenges, and concerns faced in teaching a course via the Internet.

Perceptions

Expectations

The instructor expected that she could spend more time with her family and less time in the office by being able to conduct a class from her home. The reality is that teaching via the Internet is more time consuming. It is like tutoring individual students enrolled in the class since each comment posted must be read by the instructor. When the class size grew from 17 to 47 students, the number of responses each week skyrocketed. During one week, there were 385 posted messages not including personal messages from students. This resulted in a tremendous amount of time being spent reading and responding to messages.

Challenges

The instructor faced many challenges in converting a lecture and discussion class into a format for delivery over the Internet. A web-based program provided a forum for posting messages and assignments. The lecture notes had to be written instead of delivered orally. This required an entertaining writing style designed to keep the interest of the students while presenting the information in an understandable manner. There were no students in the room to stop the instructor and ask questions if they did not understand. If there was confusion, it often was revealed later. To promote learning and interaction, students were encouraged to ask questions through written messages. When questions developed, the instructor was able to clarify by posting a response to all students in an announcement folder.

Another challenge came when a real time discussion was changed to an asynchronous discussion. Instead of the instructor being able to interject comments and correct misunderstandings like in a classroom setting, posted responses of students must be read and corrected on a daily basis. This was often difficult when there were other duties to perform. If a few days were to occur without any correction, an entire group of students could remain confused. Therefore, it was necessary for the instructor to post comments in the group discussion folders. Comments should not only focus on wrong responses but highlight good responses. One way to do this is post messages under the comments of selected students. Since discussions are not in real time, it is often impossible to summarize and bring closure to issues. Again, it was necessary for the instructor to point out the purpose of the exercise or to have students summarize their experiences. This was done by having students complete a weekly journal of what they gained from the discussions.

Instead of lecturing and discussing topics in one evening, it becomes a twenty-four hour a day on-going experience. Students expect feedback after office hours, weekends, and holidays. Misconceptions and misinterpretations must be corrected after carefully reading the posted responses of each student. Instead of being able to clarify concerns like in a classroom situation, each individual may have questions that they send to your mailbox for feedback. Since students work at different speeds, it requires being able to juggle several topics instead of teaching one topic in a night class each week.

Grading assignments on-line was a challenge for the instructor. It required long hours in front of a computer screen. Comments were made to provide feedback to the students instead of just recording a grade. Consideration for late assignments had to be weighed when students experienced access problems. Research papers were the most difficult to grade. Constantly flipping back to check references cited was a time consuming task. Therefore, hard copies were easier to grade if you have access to a good printer or students are able to fax or mail their papers.

Another challenge involved the testing of students. Not having a web-based program with a good test feature or having the students in person makes this a difficult task. Tests have to be devised to promote application of material instead of just recall. Since the best way to obtain this information is in the form of short answer and essay items, this

added to the amount of time involved in teaching a class via the Internet. Again, it was necessary to provide written feedback to students on their assignments.

Concerns

Concerns expressed by the instructor included the frustration that comes when the university server is frequently down; increasing class size without additional compensation; outdated computer equipment; and a lack of training in the use of technology. Students relying on computers at work often underestimated the amount of personal time needed to complete their assignments and periodically experienced server problems. As the number of students enrolled in distance learning classes grew, it becomes impossible to provide adequate feedback. It was often difficult coming up with new approaches to teaching without having the necessary background in the use of technology.

Discussion and Educational Importance

An effective means of delivering instruction through the world-wide-web must be developed to meet the needs of an ever growing population of adult learners. An increasing number of higher education faculties are using the WWW as a vehicle for improving instruction (Khan, 1997; Owston, 1997). The mere delivery of instruction on the WWW will not ensure learning. A potentially powerful use of the Web involves its application as a cognitive tool (Jonassen & Reeves, 1996). These tools are broadly defined as "any technologies that enhance our thinking, problem-solving, and learning" (Reeves, 1998, p. 3).

Courses must be designed to provide interaction and immediate feedback to the participants. This can only be accomplished with smaller numbers of students in classes. Boettcher (1998) suggests that the range of students fall between 12-20 students depending on the level of instruction. Larger numbers may be impossible for the instructor to provide adequate feedback. Thus, students may lose interest and fail to complete their assignments.

Students enjoy the convenience of learning and studying at home. They can even interact with students from other states. Courses need to be designed to keep their interest and to meet their individual needs. Bork (1995) suggests highly interactive multimedia learning to provide the best delivery system for distance learning. Universities must keep up with the latest equipment and training and faculty must be provided adequate support and rewards for their efforts.

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Information Technology and Teacher Education: The Missing Link

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Abstract: A *general methodology*, by means of which teachers can learn and know how to analyze a broad class of didactical processes and to design ways of incorporating information technology into the learning environment, is described henceforth. This particular methodology has been tested in the field, in several elementary schools in Israel, and examined in various in-service training courses, in advanced courses in teacher training in Beit Berl College and in a graduate degree program in Education in Tel Aviv University.

Basic Premises and Guidelines

The use of software in the field of education, like in other fields, has been motivated by certain intentions and by certain ideas on how to accomplish these intentions. The original intention, at the early sixties of the 20-th century, was similar to the common intention of organizational informatics, namely, to improve production. The idea of how to accomplish this intention was also similar to the idea used in the "professional field," namely, make a computer imitation of the productive activity and run it as a substitute. To some extent, remnants of this underlying scheme have remained with us, to this very day. Most of us believe that the value of the introduction of computers into the field of education is measured by improving the efficiency of teaching and is accomplished by changing the methods of teaching.

The question is really a question of positioning. What is the computer doing in a learning environment? Does it "do teaching"? Does it replace the teacher? Or does it extend the capabilities of either the teacher or the pupil? Does it replace anything in the learning environment? What? Or is it a new factor altogether, interjected into the learning environment?

I suggest certain principles and facts as premises and as guidelines for a development of methodologies for blending information technology into the learning activities. These premises imply an unusual underlying scheme for *educational informatics*.

Premise 1: Information technology was first introduced into the teaching and learning environments with the introduction, of the use of writing and reading as basic technologies of learning, into our cultures.

Most teachers, even though they are the heroes and heroines in the Great Saga of Literacy, are not aware of the fact that reading and writing are bona fide technologies, let alone information technologies, that support and enhance learning. Being such technologies, they obey certain principles that most information technologies obey. For instance, as Neil Postman has suggested, they do not contribute equally to all human populations (Postman 1995). In fact, even the phenomena of "learning disabilities" may be contributed to this characteristic of the effect of technology.

Premise 2: Computerized information technology can be regarded as an extension of conventional information technologies of reading and writing, that is, of conventional Literacy.

This means that besides the goal of improving the effect of education, and besides the goal of improving the appearance of the learning environments, we may agree to additional goal. Like

conventional Literacy, we may wish to provide our pupils with extended means of learning as well as with a preparation for living in an environment, an environment governed by information technologies. We may want them to become skilled as interactive and intelligent consumers of information technologies and not as a passive end-users.

Furthermore, this means that training teachers in educational informatics can start from the examination of conventionally familiar processes though from a modern viewpoint.

Premise 3: The novelty and value of modern computerized information technology stem from the handy capability of performing automatic data handling activities in various degrees of user-interactivity.

Here underlie several serious teacher-training challenges. Somehow, we have been sold the idea that teachers can achieve mastery of the secrets of our trade in a few hours of "technological training", and then become the target of all sorts of accusations for being lame in applying "the new technology" in schools. This fallacy follows from the early underlying scheme mentioned at the beginning of this section. If the programs to be used in class provide substitutes for the actions of the teacher, teachers do not have to learn to *use* them, but only to *activate* them.

Furthermore, the distinction between automatic and interactive data-handling processes, and between various degrees and formats of user-interactivity, require a profound familiarity with the principles of informatics. At least, it has to be more profound that the usual blend, especially if we wish the teachers to know what they mix into their teaching or what they require their pupils to mix with their learning.

Premise 4: A computerized process can be blended with an activity in various ways and forms. The most interactive blending can occur when the computerized process is merged, as an interactive process, with a human activity of carrying out a conventional data handling process.

Thus, our interest is focused, again, on conventional literacy, because in writing and in reading we are involved with data that physically exist as real objects outside of our minds. This means, again, that the starting point of a methodology for educational informatics can be the conventional data handling activities carried out in learning activities. This also opens up a new field of research, that has been totally ignored – the study of conventional data handling processes occurring in learning environments and situations.

The last statement may provoke two points of criticism. First, those who confuse the term "data" as used in informatics, with other uses, such as in cognitive psychology, may claim that all learning theories are focused on the data handling processes that occur in learning environments.

So, please make sure that the meaning of the term "data", as used in this paper, is limited to its usage in basic informatics, namely, the term "data" refers to the raw materials for automated data handling devices. Data, like the entities used in writing and in reading, are made of observable tokens. In fact, the main novelty of writing is in the idea that ideas can be represented by entities such as characters and ciphers that exist and can be manipulated outside of our minds.

The other criticism may come from those professionals who are familiar with System Analysis. They may claim that the methodologies of System Analysis can cover all the important qualities of conventional data handling processes.

In order to refute this criticism, one should be aware of the fact that System Analysis is based on the classical underlying scheme of organizational informatics. The analysis of the conventional data handling activities, that can be found in learning environments, requires a different underlying scheme, that is, a different intention with a different idea of how to accomplish it. If we merge the activities of the learner with software, we do not do so with the intention of relieving him or her from data handling tasks. We want the pupil to carry out

certain data manipulation activities, because they are hers and his job as learners. This is one of the main crucial differences between organizational and educational informatics.

Premise 5: A computerized process is always performed by means of a corresponding set of algorithms and data structures. A conventional data handling process is always performed by means of a similar configuration of operations and symbol organizations. Thus, blending the two processes can be realized only by interfacing the two configurations involved in the two processes.

What we need here is a new concept that encompass both the notion of a "data structure" of informatics, and a broader, less technical notion that may suit actual data handling processes that are carried out in learning activities. I will use the term "data configuration" in order to denote such a corresponding couple of symbolic organization with data operations, that has been found useful in all kinds of data handling processes, be they computerized or conventional. This notion, of a data configuration was motivated by the concept of a "data bundle" that was developed and applied by Oettinger for the purpose of the characterization of information resources (Oettinger 1993). However, data configurations are defined as strictly formal entities, while data bundles are defined also in terms of tokens, in a physical context.

Simple texts and the set of operations of rewriting associated with their usage, is one example of a data configuration. A thorough study of the usage of tables in learning environments may yield quite a few additional examples of useful and common data configurations. Likewise, lists of text-labeled cards, personal self-made glossary lists, text-labeled tree diagrams, processes described by means of flowcharts or other means of "data organizers", once we define the operations involved in their common usage, all yield plenty of examples of data configurations that can be found in conventional learning activities.

Premise 6: In any computerized process there is always a division of labor between the performed automated parts of the process and the actions performed manually by the user. When one suggests a blending of software with a learning activity one must judge the propriety and suitability of the specific division of labor - automated vs. manual – implied by it.

Thus, programs have to be evaluated on the basis of their data configurations on all the following accounts. First, we must be able to tell whether the data structures provided by the program are useful in the learning environment and for what purposes. Secondly, we must be able to judge whether the operations provided by the program will enhance the learning activity. Thirdly, we must be able to judge whether the automatic parts of the program do not include tasks that it is vital that the students carry them out.

Recent research carried out in the U.S. indicates that while time at the computer does not contribute to the pupils' achievements, their time spent on process-interactive programs does so. This means that the know-how required for applying these premises is crucial also for the classical goal of getting computers into the schools.

We have now all the ingredients necessary for the definition of the basic methodology of Educational Informatics.

The Basic Methodology

The basic methodology for Educational Informatics suggested here, is positioned in the familiar setting of conventional literacy. Consequently, it has the necessary characterisics of a zone of proximal development for teacher training (Vigotsky 1978). It consists of seven steps have to be followed in a spiral manner:

(1) Consider any didactical event whatsoever;
(2) Prepare an "informatic map" for the event by identifying all the data handling processes that actually occur in it. The simplest way of doing so is by identifying

systems upon which the processes are performed, either as input processes (creating data in the system,) as data-processing activities (making changes within the system,) or as output processes (deriving data from the system).

(3) Examine all evidences of data-configurations occurring in the informatic map of the event (if there is not sufficient evidence, return to step 2 and redo it);

(4) Choose a part of the event that can be regarded as a sub-event of it and that focuses on a single data-configuration.

(5) Specify explicitly the role of the learner in the given sub-event – what data-handling activities are vital for the learner to perform and what may be delegated to another agent;

(6) Choose a software that is sufficiently similar to the given sub-event in terms of its properties regarding the chosen data-configuration and the role of the learner;

(7) Describe the use of the software as blended with the event, based upon the identification of the corresponding points of similarity.

The Range of Applications of the Concept of a Data Configuration

Clearly, the concept of a "data-configuration" is the crucial concept of the methodology. It is in fact quite a powerful idea, since it has many applications and potential results. I will outline some of them briefly.

- The analysis of all kinds of didactical events, and even educational theories, is enhanced by the examination of the use of data in the didactical activities involved or implied in these events or theories. In particular, the notion of a data-configuration can serve as a basic concept for the study of various symbol-organizers methods, such as those applied in modern Academic Literacy

- The evaluation of software for educational use becomes more thorough if one uses this concept. In fact, the application of the concept of a data-configuration brings to light the didactical judgements necessary for a proper choice and a proper use of all kinds of software.

- Since the concept of a data-configuration can be understood in conventional terms, it serves as valid entrance concept for the professional development of teachers in the use of information technology.

- The analysis of actual didactical events, using this concept, yields routine-like characterizations and specifications of software needs based on real educational processes rather than on invented ones.

- The concept of a data-configuration offers an exciting interdisciplinary meeting of concepts drawn from general informatics, educational informatics, literacy, academic literacy, mathematics, and the cultural aspects of information technology.

Concluding Remarks

The methodology suggested in this paper was designed to yield detailed descriptions of software involved didactical activities. Since it is based on the concept of a data-configuration, it can be applied to totally conventional didactical events. Thus, the methodology can be taught to teachers as a gradient of increasing training into applied informatics. First they learn to analyze familiar didactical events, such as their own teaching, in terms of informatic maps. As experience has shown, the precision required, already at this step, is quite a burden on most teachers. Later, they have to learn to pay attention to data configurations that occur in conventional learning environments. In doing so they further their understanding of the role of literacy in the learning environments that they are directly responsible for.

The methodology itself can be expanded in several directions. It can be expanded to allow applications to all types of modern software, from hypertext, multimedia, to the widest corners of the Internet. It can be expanded so that it can be applied to non-explicit data handling activities, such as those carried out mentally. It can be expanded so that it can be used as a method for introducing new data configurations into the learning environment.

If we consider the effects of writing and reading on the oral learning systems, we can, by analogy, expect changes both in the role of the teachers and in the role of the learners that are derived from the information technologies rather than from educational reform. Teachers will not have to teach what can be learned from the new sources and tools of learning, but will be required to teach how to use these sources and tools to enhance learning. Learners will have to add new tasks related to the use of the new technologies, and they will have to learn how to use the new sources and tools for the purpose of learning. These changes will affect teacher training. For example, teachers will have to learn methodologies, like the one described in this paper, and achieve a certain level of proficiency in their application. Issues such as the expected expertise level of teachers, the definition of the contents of such training and the character of the professional responsibility for such training will be resolved during the development and the long process of assimilating this New Literacy into our educational systems.

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Online Teaching and Learning and Learner-centred Pedagogy

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Abstract: The purpose of this paper is to document the process of developing an online graduate course in Education within a learner-centred curricular framework. Current and future computer technology has the potential to significantly effect the manner in which courses are delivered The course described is developed from the perspective of responding to individuals and their interests and needs. Further, the technology is used to develop a community of inquiry though interactive, communal activities such as the community journal and electronic discussion groups. In addition, the instructor through the technology works to connect with the students and mediate their individual needs.

Introduction

Developing online courses within a learner-centred pedagogical framework creates a number of challenges for educators and developers. In many cases instructors have opted to develop courses from a from a transmission framework, concentrating on delivering critical content information that students are to learn. Currently numerous educators are attempting to develop courses from a learner-centred perspective however, the process of how to develop this pedagogy using an online format for course delivery is unclear. It is arguable that the process of using technology cannot help but shape the pedagogy. Further, Zhao, Englert, Jones, Ferdig, and Chen (1998) suggest that technology is not a fixed mechanical object, but rather a tool that is defined and reinterpreted by its developers and users. Technology can and should serve as a catalyst for changing existing practices such as the advancement of new images of learner-centred pedagogy. The relationship between technology and pedagogy is "a process of reciprocal definition" (Akrich 1992, p.222).

A learner-centred conception of education is grounded in beliefs and values about the rights, interests and needs of students, the place of subject matter in learning, and the responsibilities of the teacher. If adopted, these values and beliefs have a significant influence on curriculum. Much of the theoretical work (Dewey, 1938; Kilpatrick, 1933; Rugg & Schumaker, 1928) foundational for the development of current approaches to learner-centred pedagogy was conducted prior to the ever-changing information-age in which we now live. When these philosophers constructed their images of learner-centred many of the current complexities and challenges created by the impact of technology on education were non existent. Therefore, there is generally a lack of explicitness regarding what learner-centred pedagogy might look like within the context of an on-line course. Further, there are challenging and creative opportunities for educators interested in developing innovative ways to link learner-centred pedagogy and online course development.

The focus of this paper is on the process involved in the development of a graduate course titled "Principles of Assessment" for an online format. This course is a requirement in the Master of Education programme (Counselling and Special Education) at Acadia University and an elective in other programmes and currently is being developed for an on-line format. The students who will take the course come from a variety of backgrounds. In the counselling programme some students enter the program with a desire to be involved in agency based counselling and others are focussed on school based counselling. Further, students interested in working in special education and general classroom teaching also take the course.

The Pedagogical Assumptions and the Impact on Development

Students as Individuals

Central to the use of a learner-centred framework is the need to avoid treating a class solely as a collective, and for the instructor to be aware and respond to, the uniqueness of each student. While humans have many common experiences and needs, they also have unique characteristics and lived experiences. This creates a challenge for the development of online courses because in many cases the instructor will not have the opportunity to get to know the students prior to designing the course. One way to address this challenge is to keep the curriculum open-ended so students can enter into the course in different places and flexibility for students to follow different paths through a course is one way this might be achieved. This allows students to build on existing knowledge, interests and learning styles. For example in the course in Assessment there are different paths students can follow depending on their interest in assessment from a agency-counselling, school based guidance counselling, special education and classroom teaching. The paths send students in different directions as they explore principles of assessment. For example, a student in the counselling agency may examine the issue of gender bias in the context of a personality inventory while a student with a focus in special education, may examine the issue of gender bias in the context of math assessment. A related aspect of course development from a learner-centred perspective is that students will likely exit the course from different points. In the case of the Principles of Assessment course, students interested in examining the content of the course within the framework of a school counsellor will exit the course with attention to developing different understandings than the student who relates the course to the experiences of an elementary school teacher. While there will be commonalties in the understandings, it is the openness to allowing for differences in the path through the course that assists in establishing a learner-centred pedagogy.

Student Interest

One way curricular focus remains on the learner is if the learner's interests are the impetus for learning. This position is argued in the philosophical works of Dewey (1902, 1938), Kilpatrick (1933) and Wilson (1971). As discussed above one of the ways this need is addressed is through the effort to provide a framework of choice and flexibility for working through the course. By providing students with the opportunity to make use of the rich availability of information on the World Wide Web they are encouraged and supported to follow their interests. This is accomplished by providing a bank of suggested sites that can be visited on particular themes. For example, if a student is interested in examining assessment related to multiple intelligences they are provided with web-sites that they can visit to explore a wealth of information. Another student interested in career counselling is provided with a list of sites with relevant information. Sites are carefully selected for the bank to put students in touch with experts in the field and high quality resources. For students living a distance from an academic library this feature supports students to use relevant resources which would otherwise be difficult to access.

It is important to recognize that there are different interpretations of what basing curriculum on student interests actually means. It could be argued that the learner should be provided with opportunities to pursue what is appealing and of interest, but that the learner should be provided with stimuli from the environment which encourage the development of new interests. When planning the Principles of Assessment course for an online curriculum, one of the major pedagogical considerations was to find a way to allow students to explore their own interests, yet at the same time developing a desire to examine new content. One specific example relevant to the Principles of Assessment course is for students to understand the need to consider the impact of culture in the assessment process. Many students entering the course may not be inclined to explore such a topic on their own. The challenge for the instructor is to develop an interest in the topic. Dewey suggests that the teacher has a responsibility to "select those things within the range of existing experience that have the promise and potentiality of presenting new problems which, by stimulating new ways of observation and judgement, will expand the area of further experience" (1938, p. 75). To develop new interests, one strategy used is to take a topic and set-up a problem-solving application of information. In this case students will move beyond the presentation of new information to using the

information in meaningful ways to solve real problems in the field. Cultural bias in testing is a topic around which a problem-solving activity is designed. In this case, students extract information from the course-site and then download a Bias Review Form that they then use to evaluate a test they are currently using. In addition to developing new interests, this format encourages a meaningful application of the course content to a hands-on, real-life situation.

Community

"Individual learning" has often become central to pedagogy when students are directed to individual paths for their learning. However, developing a community, and community inquiry is essential to the learner-centred pedagogy advocated by most if not all progressive educators (Dewey,1938). When courses have been set up so students work through content at their own rates, many instructors suggest that they have adopted a learner-centred framework. Unfortunately, in many online courses this has been the model adopted. However, over-emphasis on this individualistic approach runs the risk of students becoming ego-centric in their learning and does not allow them the rich opportunity to learn from others. Based on previous work (Scardamalia & Bereiter, 1994) specific mechanisms are put in place to advance collective knowledge. These include a community journal which allows learners to make entries in the form of notes, graphics and maps which are added to a collective database about topics. Entries can be accessed by peers for review, comments and extensions. This feature, based on earlier work on collaborative knowledge-building (Scardemalia & Bereiter, 1994) allows students to make individual contributions to knowledge-building, simultaneously access other students entries in the journal and ask questions and make comments to one another in reference to journal entries. Students are encouraged to consider the journal as a reference where they can store and share rough ideas and drafts of their work. This feature of the course encourages communal-level discussion and involvement in knowledge construction.

Critical Subject Matter

When the desire to cover subject matter drives teaching, a danger arises that the focus will be restricted to material to be covered. Dewey points out that we should, "abandon the notion of subject-matter as something fixed and ready-made in itself, outside the child's experience; cease thinking of the child's experience as also something hard and fast; see it as something fluent, embryonic, vital; and we realize that the child and the curriculum are simply two limits that define a single process" (Dewey, 1902, p. 11). It is critically important that the teacher thoughtfully considers the nature of the content and the stance towards subject matter. When subject matter is simply treated as fact, with no or little emphasis placed on examination, the purpose of the educational experience frequently becomes the recapitulation of knowledge. Embedded in the view of a curriculum dominated by subject matter is the idea that there is a critical body of content knowledge one must hold before one is ready to use that knowledge in personalized ways. Dewey, however, would argue that the content must be examined in a personalized, critical manner during the learning process (Hare, 1995). Given the learner-centred focus in the Assessment course the orientation towards content is active in the sense that subject matter is being critically examined rather than passively accepted. This is particularly important in this course because students need to be able to critically examine tests constructed for the assessment of personality, aptitude, achievement and intelligence. There would be a danger to potential clients if the students approached the course content as a technician. The need to be critically reflective of the subject matter is grounded in the ethics of their professional responsibilities. The problem-solving activities discussed above with electronic discussion groups and community journal all help to develop active processing of information in a personalized and critical way.

Teacher as Facilitator

Whether it be in the selection of web-sites, the entries in the community journal, or standing back and not interfering in an electronic discussion group, the instructor influences the context for learning. Maxine Greene (1989), points out that to Dewey, the teacher has the power and the obligation to regulate certain objective conditions in order that worthwhile experiences are created. Given the importance of the

teacher's role to mentoring learning, the instructor needs to be actively involved in the course. This type of teaching involves responding to individual needs, making suggestions, asking questions and prompting the students to explore new content. To conduct this form of teaching in an online format requires individual as well as group connections between the teacher and students. The students need to know there is an instructor mediating the learning process in addition to the technology. In this course, this issue is addressed by the instructor actively participating in the community journal and discussion groups. Further, the instructor is in contact with students individually through email.

Concluding Comments:

Creating learner-centred pedagogy is a complex process. There are no prescriptions. Instead, the curriculum develops from the learners needs and interests. Given that online course development generally occurs prior to students enrolling in courses this creates a challenge for educators attempting to develop online courses from a learner-centred framework. In this paper I have attempted to describe the process involved in setting up a graduate course within this framework. Through the discussion it has been stressed that the course is developed from the perspective of responding to individuals and their interests and needs. Further, the technology is used to develop a community of inquiry though interactive, communal activities such as the community journal and electronic discussion groups. In addition, the instructor through the technology works to connect with the students and mediate their individual needs.

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Growth Management in Distance Education: How to Expand Your Distance Offerings

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Abstract: As distance learning has proven to be a viable and effective means of delivering instruction, the focus for many institutions has shifted from program establishment to program growth. The unexpected demand for and rapid success in new distance programs has presented challenges in terms of providing student support, faculty training, and course quality. In order to expand distance offerings while maintaining quality, institutions must often develop new scalable models for every aspect of their distance support function.

Introduction

Distance education has become one of the fastest growing phenomenons in higher education. With the availability of new technologies and changing learner needs, traditional universities are successfully delivering instruction to students at remote locations who would otherwise be unable to complete their studies. The success has not come without drawbacks, however. Many universities are faced with a demand for their distance programs, which overwhelms the existing campus infrastructure. Consequently, many of these institutions fail to expand their distance program, or find themselves relying on external, commercial companies to develop their distance courses

Administrative Challenges

Perhaps the most immediate concern evident in the expansion of distance programs is administration. As a distance program grows while staffing remains stable, vital functions such as registration and materials distribution can become can unmanageable. The key is to make all operations scaleable and as automated as possible. For example, a distance program, which currently has 100 students, should design its registration process to potentially meet the needs of 5000 or more.

The State University of West Georgia has seen its distance enrollment double every year since 1995, resulting in more than 1,000 distance students by Fall 1998. Prior to Summer 1998, a handbook for distance students was mailed to every registered distance student in the weeks before their courses were to begin. This labor-intensive, expensive procedure was replaced in Fall 1998. Now, handbooks are all distributed to the college bookstore, where students may order than and buy them along with their other books. Also, when the university first began using WebCT to offer online courses, student assistants were assigned to each course to help students learn the fundamentals of the new software. While this approach worked well when the university had three online courses, it did not work well two quarters later when thirty classes were fully or partially

online. The scaleable solution was to provide an online tutorial for students. This was supplemented with a telephone help-line.

Faculty Support

Another important issue is that of faculty involvement and support. In trying to win the support of faculty, the distance staff at the State University of West Georgia initially implemented WebCt with a promise to provide full course development support to all interested faculty. When the number of faculty offering online courses grew at a much faster rate than did the distance staff, a new approach was implemented. Course development was provided only during an instructor's first time teaching online. In subsequent semesters, support staff was available for one-on-one training with the understanding that faculty would actually do the development work themselves. Although this meant an increased workload for faculty, many instructors reported greater satisfaction in delivering their online courses when they did much of the development work themselves.

The notion that many faculty ultimately want to be involved in the technical aspects of course development is support by Betts (1998), who found surveyed 532 faculty at George Washington University. Two of the top three factors identified as motivating faculty to participate in distance teaching were the opportunity to develop new ideas and the personal motivation to use technology. When faculty are provided with complete training and fundamental support, distance programs are less hampered by the reality of a limited support staff.

Course Quality

A final consideration in the expansion of distance programs is quality. While distance education may appear to be a cost-saving measure for financially-strapped institutions, issues such as class size and the use of teaching assistants must be carefully considered in order to maintain the learning quality of the traditional class. Although it many appear that one can add hundreds of distance students to a class without adding the costs of walls, chairs, and other facilities, the reality is that interaction in a distance course actually increases. Because of the written nature of email and bulletin boards, internet courses can be very time consuming. Wilson (1998) surveyed 17 instructors offering full Internet course through the Southern Regional Electronic Campus. The top concern of the respondents regarding distance learning was workload, with faculty reporting a mean internet course development time of 155 hours.

Furthermore, an instructor will still have to grade an increased number of papers in a larger class. Even when teaching assistants are hired to grade papers and provide tutoring, distance courses with larger enrollments are in danger of being viewed as glorified correspondence courses. In order for faculty and students to accept distance learning as legitimate, interaction between the instructor and students must be a constant (Van Nuys, 1995). Thus, allowing distance program growth to occur by uncapping enrollment limits may not be a viable option for institutions that want to remain student-focused. While overall institution enrollments will probably be increased as a result of distance learning programs, most institutions will hire additional faculty to deliver instruction to these students.

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Conducting Education Methods On-Line to Teachers on Emergency Certification

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Abstract: This paper is a mid-project report of a study being conducted of a block of education methods courses for post-baccalaureate students teaching on emergency certification. Qualitative analysis techniques were applied to field notes, transcripts of computer-mediated discourse, project evaluations, and interviews with the professors and students. The professors and an administrator analyzed the data.

Higher education is at an institutional crossroads. Major technological innovation has set in motion far-reaching socioeconomic realignments and presents new challenges for political leaders, business people, rank-and-file citizens and, of course, educators. The exponential growth of broadband networks, e-mail, newsgroups and chat rooms has transformed the nature of human discourse just as profoundly as the printing press did in the Middle Ages. Yet most colleges and universities have been slow to respond to the Information Revolution and an increasingly wired society.

Educational Institutions must respond to these developments and recognize that their primary clients, the students entering colleges and universities, are changing, not only demographically, but also qualitatively. These New Learners tend to be older, and/or employed, raised in environments embedded with "smart products" and technologically literate. These students, in choosing a college or university, will be shopping around in a buyer's market. In order to be successful in a time when the average adult will change professions four times during the course of their working lives, educators must recognize the needs of the changing student population and the benefits of offering a variety of modalities for providing educational services. It is increasingly evident that, in order to survive and prosper in the Information Age, colleges and universities must both *adapt* traditional pedagogical models and *adopt* alternative pedagogical models. Some colleges and universities are beginning to respond to these challenges by updating traditional courses with various educational technologies, and funding, designing and implementing new computer-enhanced curricula.

Distance education -- which utilizes telecommunications to bridge time and space limitations in order to disseminate learning experiences, ideas, and information to produce exchanges between the teacher and class members (Boetcher, 1997) -- offers a flexible alternative. Web-based distance education offers the greatest flexibility in terms of time, distance, and accessibility. More than 40% of U.S. households and 85% of U.S. businesses have computers and, although a lesser percentage of households and businesses are connected to the Internet, the online community is growing exponentially. The number of adult users of the World Wide Web tripled from 2.2 million in 1994 to 6.6 million in 1995. Moreover, between July 1995 and January 1996, the number of commercial host computers grew from 1.7 million to 2.4 million

Today, with information so readily available, educators cannot afford to collect and transmit knowledge as if it were a static commodity. A new pedagogical orientation will be required to serve the kinds of students who go beyond simply gaining a set of skills and a body of knowledge. In this new model, professors must assume a new role -- that of a coach or guide who helps students process information and work collaboratively in groups. Tasks may vary among students, and students may sometimes direct their own learning and design their own

projects. Professors must become facilitators, helping students to discover for themselves the power and efficacy of skills specific to critical thinking and problem solving. As Cox (1997), Frazier (1997), Boetcher (1997), Margolies (1991) and others have suggested, a college education should prepare students for new forms of experience beyond the campus. It should help them understand the complexity of that experience and should equip them with the ability to comprehend and negotiate that complexity. From this perspective, the goal of the new learning paradigm must be to help a generation of students become dynamic, life-long learners who can thrive in the emerging Information Age.

What opportunities and challenges face teacher preparation as we enter the 21st century? Traditionally, undergraduate students have been prepared for teacher certification during the course of their four-year baccalaureate degree. Now, in an effort to bring qualified people into the teaching profession, some states are offering degreed adults the opportunity to teach under emergency certification while taking courses designed to address teaching methodologies. This has meant that a first-year teacher would have to take courses at night, on weekends, or in the summer in order to fulfill these requirements. Can Web-based instruction offer a viable alternative to traditional campus-based classes? Will the quality of education be compromised, enhanced, or remain the same? What are the administrative and pedagogical issues that arise in the planning and implementation of these classes? Can Web-based courses be constructed so as to be engaging, motivating, and highly interactive? Do students feel they are well served? These are the questions that guide this study.

The Study

This study focuses on a Secondary Methods' block course for post-baccalaureate students seeking teacher certification. At this time the course is in progress and the findings of this study are a midpoint look. This course is being taught 80% asynchronously through the Internet and 20% synchronously in a classroom at a state university. The target population is composed of post-baccalaureate students who are employed under emergency certification in secondary school settings. The On-Line Secondary Methods block (hereafter called Methods On-Line) consists of four courses -- Classroom Management, Content Area Reading, Secondary Methods, and The Professional Educator -- framed into one integrated block focused on the issues and concerns of new teachers as well as the developmental processes of teaching. Students are taking these four courses concurrently over two semesters.

After an on-campus introductory class, the course was taught via course pages accessed through the Internet. Additional classes were scheduled for the mid-point and end-point of each semester. Assignments were posted on the Web and students read and posted their reading responses on the "forum" (electronic threaded message board). In addition, students participated in on-line simulations of classroom activities. These simulations were offered as problems posted on the "forum" for the class to respond to. Students also posted their reflections about their field experiences. Each student was required to create a personal home page in which they provided links to their papers, projects, and a Web-based resource list for teachers. This home page also served as an electronic portfolio.

In order to participate in the course, students were required to have Internet access to the World Wide Web. They were also required to enroll in all four courses over the course of the two semesters. They had to be employed in a secondary school under emergency certification.

Evaluations were based on successful completion of reading responses, participation in forum discussions, participation in classroom simulations, completion of field-based activities, completion of papers and projects, and the construction of a web page which served as an electronic portfolio.

Investigators for this project included the two professors of record for the course, and a university administrator. Informants for the study were the professors, the administrator, and the students.

Data sources for the study of the project included student products, transcripts of on-line discussions, field journals of professors, an administrator interview, and student on-line interviews.

Data was analyzed utilizing qualitative analysis strategies.

Findings

The findings of this study are presented in three distinct voices: the administrator (immediate supervisor) and the two professors. Students' voices will be part of the final study.

The Immediate Supervisor

Sam Houston State University (SHSU) like most other institutions of higher learning, is attempting to meet the diverse needs of students through technology based coursework. Jeannine Hirtle and Robin McGrew-Zoubi created a proposal to teach the secondary methods block of courses on-line for a special population -- post-baccalaureate certification only students with full time teaching responsibilities. As chairperson of the Language, Literacy, and Special Populations (LLSP) department and an instructor within the traditional secondary methods block, I was intrigued, but also concerned about quality of learning.

In the traditional program, three faculty members teach 9 of these 12 hours within the block. Field service in public school secondary classrooms is an integral part of the methods block. The courses are taught from 8:00 - 1:00 two mornings a week and field service is planned both during that time and some hours according to individual schedules worked out with mentor teachers in the public schools. Since this schedule is impossible for post-baccalaureate students teaching full time, the need for alternatives is great. The proposal submitted by Drs. Hirtle and McGrew-Zoubi was very complete. The professors included a syllabus, which integrated the courses and specified a time line for meeting all learning objectives. Objectives were tied to the State proficiencies for teachers and to the domains for the State examination in secondary professional development, which all teacher education students must pass in order to become certified.

I met with the Chair of Curriculum and Instruction (C&I) and we agreed to support the proposal to offer these courses for graduate credit and to encourage Hirtle and McGrew-Zoubi to share their proposal at the next joint LLSP / C&I faculty meeting. The reaction of other faculty members was a surprise. Several persons who teach technology related course questioned the expertise of these two faculty members to teach a technology-based course. Both Hirtle and McGrew-Zoubi have done extensive professional development in the areas of Web-based courses and instructional uses of technology. Turf also became an issue. Faculty members who teach the courses in the traditional program questioned if two instructors could effectively teach the four courses in the integrated plan described in the proposal. Discussion was open and lively and I stressed my belief that individual instructors don't own courses and that I felt Hirtle and McGrew-Zoubi were very qualified to teach the block.

The next hurdles were the registration procedures and entrance requirements. Most post-baccalaureate students are on emergency permits with local school districts. Methods On-Line involved taking four graduate-level courses. Although the content would be integrated, students needed to register for two courses in the fall and two courses in the spring. At SHSU, post-baccalaureate certification students who apply for the graduate program may only take 6 hours prior to providing the university with Graduate Record Examination (GRE) scores. Most of the students interested in the Methods On-Line were not planning to get a master's degree at this time. Registration can be accomplished by computer or telephone once a graduate application had been filed, but these procedures created roadblocks for some students. Students did not always have access to registration and payment deadline dates. Drs. Hirtle and McGrew-Zoubi spent many hours acclimating the Methods On-Line students to the university.

Once the class was established I began logging on regularly to observe the activities and student progress. I have had minimal training in Web-based courses, so I was interested in learning the process. Since I teach the Content Area Reading and Writing in the traditional block, I especially enjoyed noting the differences in assignments and activities. Each Methods On-Line student was teaching and had access to the classroom. Many of the assignments could be tailored to meet the immediate needs of these teachers. I have actually had the students in my traditional Content Area Reading classes use the resources from the Methods On-Line for several assignments. The policy of establishing forums for continuous student responses -- not only to the instructors' assignments, but also to each other's products -- provided opportunities similar to class discussion

activities in the traditional classroom. I have noted that students make a response and then move on to another assignment. Drs. Hirtle and McGrew-Zoubi, in their responses to student work and comments, encouraged students to return to earlier forums and read other's comments. At the end of the semester, all on-line conversations can be evaluated for growth in understanding and insight. The assignments were very similar to those in the traditional block courses, but the students in the on-line course were moving at a faster pace. With the course workload and the full-time teaching, I wonder if there was time for reflection and assimilation. I hope the teachers from schools in close proximity are meeting together and discussing assignments and teaching activities. I think it would be worthwhile to add this component. These teachers need the support of colleagues and mentors. Surveying the Methods On-Line students to determine their perceptions of support from other students and faculty would be a good idea at the end of the first semester.

My biggest concern is with the time required of Drs. Hirtle and McGrew-Zoubi. They are spending many hours on-line, constructing assignments or responding to forums. I think they need to document the time and activities and compare them with the preparation and grading time of the traditional block. Possibly, once the course is established, this concern would be less. This time on-line also reduces the interaction Hirtle and McGrew-Zoubi have with other faculty members. As a result, few faculty or administrators are aware of the innovative teaching or the demands of these on-line courses. I hope faculty will support the efforts of these two faculty members; however, they must find time and ways to share their experiences with colleagues. At this point, I support the on-line course for the post-baccalaureate, certification-only students. I will try to get more faculty interested and involved in the project, and finally, I will look closely at examination scores for the State certification exam. If these students prove to be adequately prepared, the Methods On-Line will have met a great need for our non-traditional students.

The Professors

The creation of a Methods On-Line course posed a number of unique challenges. After our initial proposal was accepted, one of the first problems we faced was how to recruit for the course. We created a brochure that advertised the course and sent it out via the local Education Services Center's distribution route. We conducted phone interviews with students who called in response. During these interviews we explained the course concept, explained the criteria, reviewed our university's admission policy for post-baccalaureate students, and emphasized the necessity that the students have access to the Internet as well as basic computer literacy skills.

Students who wished to be part of the on-line course had to agree to participate in all four courses. One student wished to participate and had completed two of the courses. These two courses were "on the books" administratively, and therefore, this student did not have to pay tuition. Because she did not pay tuition, she did not have a university computer account and that prevented her from participating in the university-managed on-line message board. We had to contact the Director of Computer Services for a temporary account, but it caused a delay in posting her lesson responses.

Financial aid also posed challenges for our students. Students who were on financial aid needed to receive grades each semester in order to maintain their aid and qualify for additional aid in the next semester. Because our course was organized to run over the course of two semesters, we arranged to give students incompletes after the fall semester with the understanding that they would receive credit for four courses at the end of the second semester. We had to receive special permission from the financial aid officer to have these students continue to receive aid.

Technology was a special challenge to many students. The technical expertise of our students was extremely diverse and not all students had the Internet access they thought they had. Some students were relying on school networks and could not maintain consistent access on these systems. Many did not know how to receive and send e-mail or access the web. Other students had privacy issues concerning receiving e-mail because they used a common faculty account at their school. Some students could send e-mail, but could not set the preferences to reveal their identity, so we occasionally received unsigned email from defaultuser@domain.com. We received one frantic call from two students who said Netscape was not accepting any new customers.

We also had problems with students accessing the threaded message boards we used for class discussion. These message boards, called "forums," required a login and password. Our students went into login and password

overload. They had to learn one login and password to access their Internet provider, another to access their e-mail, another to access their university computer account, and still another for the threaded message board. Our students were thoroughly confused and it took weeks to sort all this out. We received many frantic phone calls from students who were trying unsuccessfully to post assignments.

Because of the time constraints involved in creating this uniquely formatted program, we each took responsibility for designing, posting, interacting with students, and assessing a lesson each week. Hirtle took the odd weeks and McGrew-Zoubi took the even weeks. The common denominator that guided our decisions about what topics would be taught was the guiding question, "What will it take for this teacher to best survive and thrive as a first year teacher." Our lesson topics included questions such as: How do I get off to a good start in my classroom? How do I know what students are supposed to learn? How do I plan an effective lesson? What part does assessment play in learning?
Additional questions can be found at http://www.shsu.edu/~edu_jsh/schedule.html.

Lesson Design

Dr. McGrew-Zoubi: Lesson design was a lot like writing lesson plans for someone else to use. All the instructions had to be very concrete and literal and I had to pay special attention to the sequence in which I stated things.

Classroom Management is all about broadening perspectives. Reading a passage, considering our own experience with the topic, and then looking at other students' perspectives made discussion critical for the success of the lessons. This fall we spent a lot of time on cultural norms for behavior. The way students are raised and the environments from which they come affect the way they think things should occur at school. In discussion, they clarified their perspectives in the context of discussing effective schools and best practices. Interactive discussions helped them hone what was important to practice, and define why it was important. Everyone became an active participant. Because of the course requirements, participation was mandatory. The quieter students who might have held back in a traditional class discussion reported they felt freer to reveal their thoughts on the forum. Some reported that they had time to compose their thoughts before they said them, and this helped them take the opportunity to be heard.

The following discussion excerpt includes a posting from a student whose spontaneous contributions centered on her inability to use technology efficiently and the problems that she had in submitting her work. In this response to the forum, she focused her responses on the discussion topic, making it possible for her to enter the conversation without the inclusion of caveats and disclaimers as to how she entered.

> At risk at my school means students are "at risk" of failing or dropping out... We have a huge problem at our school - teen pregnancy. Of about one hundred students, seven are pregnant right now and five already have a child. If you consider that half of our students are girls that makes the statistic 24%! . . . I know that teenage mothers are at risk of dropping out, so shouldn't our focus be on the ones who aren't pregnant yet? I know that sex education is "risky" business but these kids are busy educating themselves. I have been working on a plan to help educate these students. The idea was born last year when one of my best students came up pregnant. We have a new administration now ... I feel that teachers who are always on the lookout to "bust" them for every little thing are very discouraging to them. They start to feel like they can't do anything right so why try. I try to focus on the good things... One child saved is worth all you had to do to save them.

In this exchange she had six respsonses, all endorsing her efforts the make positive and meaningful changes to benefit her students. This type of response is often lost in a face-to-face discussion. Support and affirmation can be lost in the intensity of the discussion.

Assessment became a matter of recording the fact that the students posted thoughtfully, reflectively, and meaningfully to the professor and colleagues. Without the forum, this critical pedagogical strategy of whole class discussion would have been impossible. Engaging in multiple responses that are posted for the duration of the course helped created a community of learners who were continually growing through dialogue.

Dr. Hirtle: Many of my early lessons were formatted to provide students opportunities to engage in what they were reading about. For example, Content Area Reading students are instructed to activate student schema through a variety of strategies. I asked students to complete an anticipation guide before they read chapters and to post their responses in a reaction guide afterward. If they were reading a chapter on writing lesson objectives, I clearly posted the lesson objectives for this on-line lesson to model the technique. Their activity for this lesson was an application of what they read. If the lesson was about communicating instructional intent clearly, students created lesson objectives and posted these to the appropriate forum

Students posted the activities they created to the forums and responded to each other. I created rubrics to evaluate these activities and after evaluating students, e-mailed those rubrics because I did not want to publicly post a grade. Sometimes, this created problems because our school e-mail server went down and grade reports got lost in the mail.

One of the biggest problems I faced was creating too much for students to do. Our colleagues were suspect as to how well a methods course could be taught on-line because so much modeling and interaction are required to make the course successful. In an effort to create that environment in a virtual sense, I filled my lessons with opportunities to respond in forums, activities to participate in, and projects to create. When I met my students face-to-face at mid-semester, there was general concern about the workload and about their abilities to meet the demands of the course and their jobs. Dr. Zoubi and I honestly laid out our objectives, the concerns of our colleagues, and our concerns about adequately preparing the students for the certification exams. We then solicited input from the students about how we could best satisfy those demands and make the course more manageable for them. Tension dispelled as we had this dialogue, and I streamlined my lessons.

Assessment was another big issue we faced. How would we provide regular feedback to students and allow them the opportunity to grow from that feedback? Both Dr. Zoubi and I set a policy that if students were dissatisfied with a grade, they could redo the assignment within a reasonable time frame, until they are satisfied with the product. We would provide feedback and then set a deadline on resubmission. Most of our students did resubmit and we adjusted the grades. We sent grades through an electronic gradebook program with an e-mail and progress report feature. While both Dr. Zoubi and I prefer to give qualitative assessment, we did assign number grades to student work, and students seemed to take comfort in the quantitative reporting of their progress. They responded quickly to question marks, incompletes, and zeroes in their assignments, often admitting that they simply overlooked an assignment. We found it important that on-line assessment come regularly, in quick response to the work, and that instruction is influenced as a result.

Conclusion

Methods On-Line and this study are a work in progress. We are continuously reflecting on and adjusting our practice to align to our evolving theory bases, and we look forward to publishing the conclusion to this study after the completion of the course after the end of the 1999 Spring semester.

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Partnership Learning: New Models of Videoconferencing in Education

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Abstract: Collaborative efforts between Baylor University's School of Education and regional public school districts as well as between Kentucky State University and Dixie Magnet Elementary School, highlight the emerging changes in ways both PK-12 and Higher Education are thinking about the processes of Distance Learning. These strategies and the philosophy behind them have broken new ground in the development and implementation of new models for distance and teacher education. These models – we call them "partnership learning" – have evolved out of the desire by some for distance learning technologies to be more than "a talking head." The most obvious differentiation between the one-to-many characterization of traditional distance learning is the many-to-many scenarios seen so widely in applications based on the newer models. Out of this "partnership learning" environment we find real examples of motivated learners and excited instructors.

1.0 Introduction

The techniques and technologies used for distance learning, indeed the definition of "distance learning" itself, have been changing since the 1800's. Each decade, it seems, has brought with it a new innovation in the mechanism or delivery or strategy of distance learning. However, only in the late 1990's have we begun to see such radical changes in approach that we would classify them as a totally "new" approach to distance learning. Each of the evolutions from the 1800's to the present have provided, in theory, a more efficient, more effective, more timely means of communicating content to a larger or previously-untapped audience. The model, from decade to decade, has been a one-to-many approach. Over time, this model developed into what we have known as "distance learning," what we now call "traditional distance learning" or even "distance teaching" since the distinguishing factor has been the medium or method of content transmission.

While effective in sharing resources and proven to provide at least equal educational experiences for students, "distance teaching" applications have not been the model that best fit the objectives of cooperation, collaboration and change. For that purpose, Schools of Education and their collaborative schools can develop several connectivity strategies and usage patterns that represent an emerging model for distance education.

For instance, the teacher education programs at Baylor University (www.baylor.edu) and Kentucky State University (www.kysu.edu) apply the new models to use videoconferencing as a communication tool between pre-service and in-service teachers. These environments have allowed students to dialogue with master teachers, observe specific classroom situations, practice teaching and develop professional collaborative relationships without ever leaving campus. This has generated tremendous interest in the teacher education process. Pre-service students now have a practical way to link theory and practice before they student teach, and in-service teachers see these relationships as a way to keep up with current theory and provide mentorships for developing teachers.

2.0 Major Ideas

2.1 Digital Communication

Both the present and the future of teacher education are being deeply impacted by the use of high-quality digital video communications in the teaching and learning environment. Through these technologies, teachers and students are creating interactive experiences such as collaborative discussions, multi-team activities, and projects that take place both in the traditional teacher preparation classroom and in the practical PK-12 field classroom. These activities are characterized by the application of new models for teacher preparation, interaction between groups and visual communication (i.e., compressed video communications). The applications of these models are providing avenues for teachers and students to enhance their regular communication, as well as serving as a catalyst for expanding applications of the technology in the education enterprise.

2.2 Traditional Models

The predominant mind set for educators has been on the traditional model of distance education. The application of this model tends to focus on the distant communication in a one-to-many format. That is, they follow the metaphor of content dissemination where one person (or site) serves as the origination point and other persons (sites) are the receiving locations. Classic examples of this model include the "distance teaching" application of shared instructors for rural school districts. For example, one large rural school has a single physics teacher who uses distance education processes to teach classes at the local school as well as additional schools. Another classic example is that of concurrent enrollment between higher education institutions and secondary schools. For instance, beginning English course at a local community college includes both community college students and local high school seniors who take the course remotely by video and receive credit at both institutions.

3.0 Transition to a New Model

Combining digital and communication technologies enhances the already powerful function of video technologies. At its heart, video technologies provide a "presence." Video technologies have provided the "end user" with a presence at events (royal weddings and funerals, acts of war, and natural disasters) previously restricted to a limited number of participants; video technologies provide a presence to environments (ortho- and other "scopic" surgeries, deep-sea ocean liner wrecks, and moon landings) that are inaccessible in any other way; video technologies provide a presence to processes (hummingbird flight, seed germination, and chemical reactions) impossible to witness without aid (Rogers, 1995). Nicholas Negroponte (1995) describes a society where home and desktop video capabilities provide millions of users with the potential to create and distribute their unique video "presences", which is one of the prime agents changing the model of traditional distance communication.

4.0 Models and Examples

4.1 Partnership Learning "umbrella"

The traditional model for "distance learning" captures the essence of its function in its title. The primary barrier was geography ("distance" learning). The infrastructure and technologies are now in place which minimize the geographic barrier; therefore, new models and new ways of thinking about the technology must, in both design and nomenclature, emphasize the changing nature of the technology and applications. We use the term "Partnership Learning" as the umbrella for thinking about these new applications. It accomplishes at least two tasks: it shifts the focus from the barrier (distance) to the process (partnership); and it continues the emphasis on outcomes (learning).

4.2 Model Components

4.2.1 Shared Discovery

Among the primary components of partnership learning is the notion of collaboration. However, the type of collaboration envisioned in partnership learning should not be equated with "effective communication" (as is frequently the case in many scenarios). Rather, the level of collaboration sought in the new model is based on the idea of collaboration as described by Michael Schrage (1990), "collaboration is the process of shared creation: two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own. Collaboration creates a shared meaning about a process, a product, or an event."

4.2.2 Team Learning

A second component of the partnership learning model is what Peter Senge (1990) calls "team learning," which has three important characteristics: "the need to think insightfully about complex issues; the need for innovative, coordinated action; [and] the role of team members on other teams." These "critical dimensions" do not describe the traditional model. However, if appropriately considered, these dimensions can be incorporated into a partnership learning model.

4.2.3 Accessible Expertise

The rapid development of the Internet and the advancements in communication technologies render the traditional model's reliance on "remote expertise" obsolete. Once again the nomenclature emphasizes the barrier (distance) which was to be overcome. The partnership learning models emphasize access rather than geography; therefore, the partnership model emphasizes "accessible expertise." It draws attention to the fact expertise is valuable because it is accessible, not because it is remote. This notion focuses attention on the importance of relationships and the idea of "building communities of learners" (McCaleb, 1994).

4.2.4 Primary Content

Individuals such as Edgar Dale (1946) and Jerome Bruner (1969) envisioned the forth element of the partnership learning model long before current technologies made it practical. Dale and Bruner both recognized the importance of primary experiences. Susan Kovalik (1994), a more recent advocate of real experiences, insists that anything that can't be studied/observed/experienced in the students' real world, should not be part of the curriculum. Many of these experiences cannot be provided on a regular basis in the vast majority of classrooms. However, primary content providers (zoos, museums, business, etc.) acting as learning partners can provide unique on-going experiences that extend beyond the traditional classroom. As more and more institutions and organizations look to make their "educational mission" more explicit and external, the opportunity exists to connect those missions to the educational purpose of schools and as a result, increase the "real world experiences" which can be included within the classroom curriculum.

5.0 Some Examples in Teacher Education

5.1 Technology Support

A new level of professional development and professionalism is empowered by the connectivity and presence of on-demand access to other environments. Technology coordinators at schools, as well as the School of Education, use the videoconferencing equipment to access issues in hardware, software and integration issues as they arise. Additionally, staff members at the schools find another source for technology support when their local technologist is not available.

By sharing experience and information, this example takes learning beyond the realm of the defined curriculum and makes Team Learning an actual process for both students and staff. The use of visual communication for learning becomes a regular, expected activity.

5.2 Expert Teacher

A methods course within the School of Education watches a specialist in a local elementary school conduct a program with real students. After the specialist has dismissed her students, the university students receive instruction in the methodology and purpose of the program and question its role and implementation with the specialist.

This is an example of using digital communications over video for Accessible Expertise and Shared Discovery. Pre-service teacher education students have access through this process to an experience that is difficult to reproduce and impossible to fully describe through anything but experience.

5.3 Demonstration Classroom

A curriculum and instruction development course in the School of Education observes, as through a one-way window, the start of the school day and the transition from subject to subject for a school. After the startup routine was complete, the teacher leaves the class with a substitute to move to another room where she openly discusses the rationale behind her actions with university students who could apply the theory of their classrooms to the practice of the elementary school.

The demonstration classroom is an example of both Team Learning and Primary Content. Students have the opportunity to see a variety of teachers and styles in actual practice and do not have to rely on manufactured environments for authenticity.

5.4 Intensive Topic Study

A graduate program develops a series of in-depth reviews on a particular area of expertise or philosophy. After extensive research into the ideas involved, the students use digital video communications to interview key personnel and develop their own level of expertise.

An example of Primary Content and Accessible Expertise, intensive topic study allows a first-hand interaction with content that provides personal meaning to formerly abstract ideas.

5.5 Museum Content

A teacher education course, public school classroom and educational museum collaborate on a curriculum-based project over videoconferencing. All partners plan the interaction based on instructional theory, student needs and available resources. Original, primary content is provided by the museum with interaction from the student sites. Students elaborate on content through collaborative projects and "present" the information to the content experts for qualification.

By providing Primary Content to the learning experience, this interaction gives students an immediate personal engagement in the learning process. The Team Learning approach further accentuates the ability to make personal and meaningful connections.

5.6 Practice Teaching

Pre-service students plan and execute content lessons with real students in multiple locations over videoconferencing. Children are engaged in the content due to the robust planning and attention paid to visual and tactile learning experiences by the pre-service teacher. Following the lesson, the children and their teacher give the practicing pre-service teacher feedback on effective strategies and areas requiring attention.

This is a very effective example of Team Learning that uses a communication strategy for providing feedback. Notice that both the pre-service teacher and the children in the PK-12 classroom both serve as "sources" of expertise.

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Supporting a Web-based Curriculum with a Diverse Mix of Authoring Competency

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Abstract: This paper presents an academic web-authoring tool called AutoHTML. This tool, a work in progress, is designed to allow the novice user the ability to construct high level web pages with a consistent look and feel. The system works with a standard web browser without the addition of component plug-ins. Additional HTML meta-tags are introduced that allow the duplication, deletion, and modification of elements of a web page. The paper also discusses the need for consistency in course web pages.

Introduction

Currently, there are many authoring tools on the market that ease the development of web pages. Yet, these commercial authoring tools are inadequate for the incrementally developed web pages seen in academics. Academic web authoring tools must have several key features: 1) they must work from a common framework and 2) they must allow for easy modification of the common framework. These two points are the motivating ideas behind our development of the AutoHTML system. It is important that students see consistent structure and format of class web pages throughout the course. The reason for this is that students should be able to acquire the needed information without repeated interpretation of its presentation from the instructor. This has been true in the hard-paper classroom for generations. All of the tests have a similar format to all of the other tests in the class, and all the assignments have a similar format to all of the other assignments. This is also true for quizzes, the syllabus and all other repeating documents. The only difference in form, between documents of the same type, will generally be the addition or removal of some fields and the repetition of other fields. For example, the first quiz may have eight questions and the second quiz may have ten; both documents have the students place their names at the top of the quiz and the format of the questions is the same for both quizzes. It is for such reasons that it is necessary to work from a common framework. A common look and feel for web-based documents can be realized with AutoHTML. Another theme of AutoHTML is the desire to make it useful for web authors of all capabilities. The following section will give an overview of what AutoHTML does, then subsequent sections discuss the usability of the system by both a novice and experienced web author.

Executive System Overview

The simplest AutoHTML system consists of a template and a set of scripts which transform this template according to the design of the template and interaction with the user. Templates are ordinary web pages written in HTML which also include meta-data in the form of Merge Fields and Sections. Both Merge Fields and Sections resemble enclosure-style markup tags, but they are embedded in standard HTLM comments, so that they do not appear when the page is viewed in a web browser. Merge Fields are used to identify parts of the page that may need to be modified. Sections are used to identify parts of the page that may need to be duplicated, destructively deleted, non-destructively deleted, or restored (from a non-destructive

deletion). Merge Fields can be nested within Sections, but no other nesting of Merge Fields or Sections is allowed. Processing an AutoHTML template consists of 4 primary steps:

1. Create a web-based form from the template, which allows the user to indicate which action to take for each Section in the template and submit this form back to the system.
2. Use the actions submitted in step 1 to modify the template by duplicating, destructively deleting, non-destructively deleting, or restoring sections of the template.
3. Create a web-based form from the template, which allows the user to make changes to the contents of Merge Fields in the template and submit this form back to the system.
4. Use the new Merge Field values created in step 3 to modify those Merge Fields in the template.

Steps 1 and 2 must be done in sequence. Steps 3 and 4 must also be done in sequence, but the operation cycle may involve repetitions of these sub-cycles as needed.

Creating a Template

General Template Creation Process

Creating a template usually starts by modifying an existing web page that represents a class of web pages that are desired for a site. In other words, there may be many web pages like it, using the same style, general appearance, and basic components, but their specific contents will vary.

Step 1. Identify portions of the page which represent a repetition of the same kind of entry. You will usually note recurring pieces of text or format which distinguish such parts. Enclose one of these in a Section meta-tag, and delete the others.

Step 2. Identify portions of the page which are optional. Enclose them in Section meta-tags.

Step 3. Identify portions of the page whose content may vary in each specific instance of the template. Enclose those parts within Merge Field meta-tags. Remember that *anything* within a Merge Field is subject to being changed. To remind yourself of that fact (and to make your template more descriptive to a user), replace the changeable part with text that makes its purpose clear.

Rules for Creation of Section and Merge Field Meta-tags

The Section meta-tag is an enclosure tag (meaning that it actually consists of two paired tags) of the following form:

```
<!-- ##SECTION## identifier --!>
  contents of the section
<!-- ##/SECTION## --!>
```

Neither meta-tag may be split between lines, although the *contents* of the section will usually span many lines. The identifier is any string of alphanumeric characters, including underscore (_), and is used to uniquely identify a given section. Do not end a section identifier with an underscore followed by a sequence of digits, as this is reserved for system use when the section is duplicated.

The Merge Field meta-tag is also an enclosure tag of the following form:

```
<!-- ##MERGEFIELD## identifier --!>
  contents of the section
<!-- ##/MERGEFIELD## --!>
```

As with Section meta-tags, Merge Field meta-tags must be complete on a single physical line. Merge Field identifiers follow the same rules as Section identifiers, and all identifiers, regardless of type, must be unique. Finally, no meta-tag may be placed within another individual HTML tag. For example:

```
<A HREF="<!-- ##MERGEFIELD url --!>http://cs.nlu.edu
<!-- ##/MERGEFIELD## --!>">
```

would be an error, but:

```
<A HREF="<!-- ##MERGEFIELD url --!><A HREF="http://cs.nlu.edu">
<!-- ##/MERGEFIELD## --!>
```

would be fine. Also, at this time, Sections may not be nested within other Sections.

Example of Template Creation

Consider the following web-published class assignment:

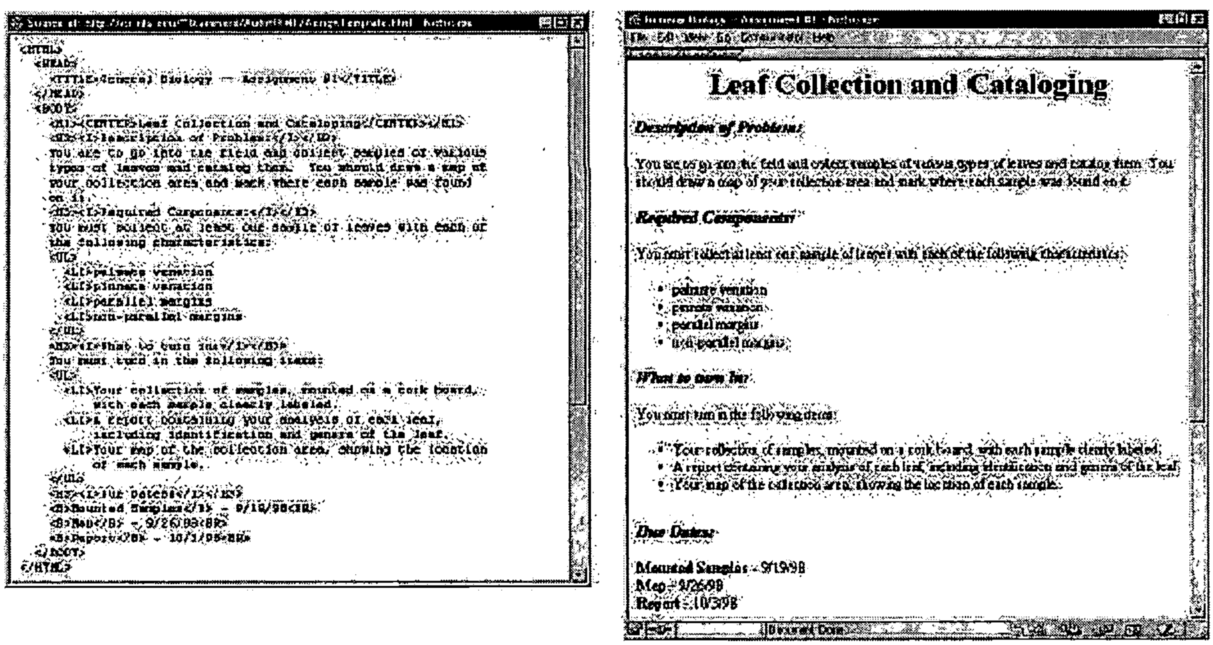

Figure 1: HTML code and browser display of a web page suitable as a basis for a template.

In Step 1, the repetitive elements of the web page are identified. Each item in the required components thus makes a section, as does each item in the "What to turn in" part, and each due date. Using Step 2, the heading and introductory text of "Required Components" is identified as optional, but it is decided that the other parts will be present in every assignment. Each Section identified by these steps is enclosed within Section meta-tags.

After identifying the Sections, Step 3 is used to set up the Merge Fields. We want to be able to make changes to the following items in the page:

- Title of the assignment
- Text of the problem description
- Leading text for all required components
- Particular required components
- Items that have to be turned in
- Descriptions of due dates
- Dates of due dates

Note that while most of these Merge Fields will appear *within* a Section, some (such as the assignment title) do not. These are known as "orphan" Merge Fields. For each of these areas, *one* example is enclosed within Merge Field meta-tags, and the others are removed. The text of each is also made more general and explanatory. The resulting template looks like this:

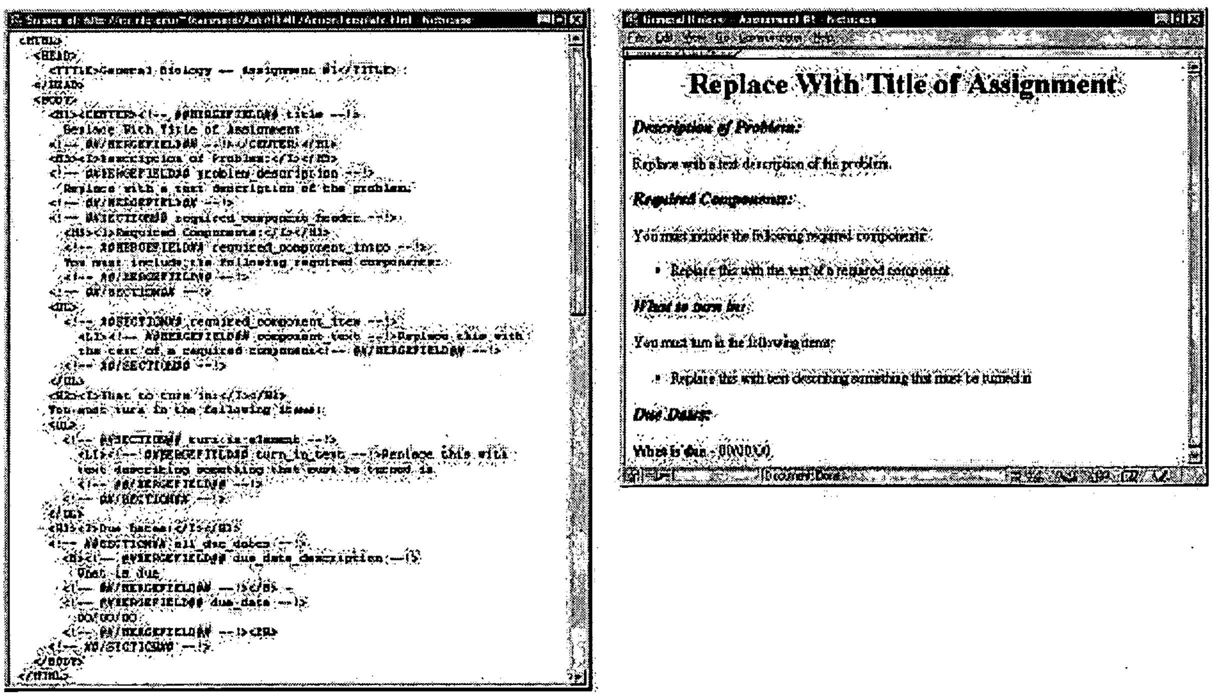

Figure 2: HTML code and browser display of the resulting AutoHTML template.

Using a Template

Once a template has been created, a novice user can use it to create an entirely new web page. To do so, enter the AutoHTML system and choose the template you wish to base your web page upon. A form similar to the following is displayed in the browser:

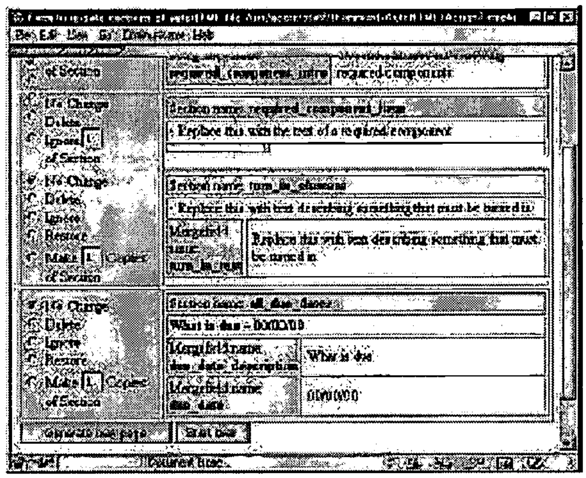

Figure 3: Browser display of a form to update Sections of an AutoHTML template.

AutoHTML is designed with simple radio buttons to select actions to be taken for each Section in the template. Each Section of the template is displayed with the option to perform "No Change", "Delete", "Ignore", "Restore", and "Make Copies". By choosing "Delete", that Section will be deleted from the template permanently. By choosing "Make Copies", the user can make as many *additional* copies of that section as the user wishes. "Ignore" is a non-destructive delete that allows the user to create a web page that does not display that section in the browser (it will still appear in this form). That section can be added back to the web page by using "Restore" on it at a later time. After all choices are made, the user clicks the "Generate new page" button, and the template is modified on the server.

After the template has been re-generated with appropriate Sections, any Merge Field can be modified to reflect desired textual changes. At this point, the user is presented with the option to view the new web page, or to modify its Merge Fields. When "Edit Merge Fields" is chosen, a form similar to the following is displayed in the browser:

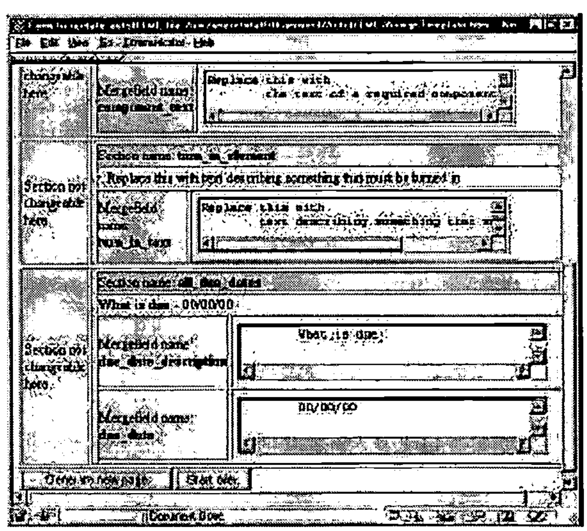

Figure 4: Browser display of a form to update Merge Fields of an AutoHTML template.

AutoHTML uses a straightforward fill in the blanks format to eliminate the need for the novice to understand HTML tags. Yet, the more experienced user can insert HTML tags as desired, since the text will be replacing actual HTML code. The web page (which is still a template) is then re-generated by clicking the "Generate new page" button. This cycle of adding and removing sections and modifying merge fields can be repeated indefinitely until the desired web page is created.

Benefits of AutoHTML

AutoHTML is a system that gives the novice user a way of developing high-quality and consistent classroom web pages. This increases the web-presence of the classroom without undue workload on the instructor. This added web-presence gives students an accessible resource at all times. This adds immediacy to the instructor's access to the students. In other words, the instructor need not wait until class time to make announcements, answer questions, or to present assignments. This is especially important in the area of distance learning and in classroom environments with infrequent meeting times, such as once a week. Also, since AutoHTML templates are ordinary web pages, they can be modified directly by an expert web author doing more elaborate page development, as long as the simple rules for AutoHTML meta-tags are not invalidated. AutoHTML will simply act as a tool to reduce creation time of similar pages.

AutoHTML also promotes the gradual introduction of HTML to new users. A new user will be gradually exposed to individual HTML elements such as anchors and formatting tags in the content of Merge Fields. As a user gains understanding, new HTML tags can be added to the merge fields. In this way, a new user can use a limited set of tags without having to learn a large set of tags in order to get started.

Consistency in the look and feel of an organization's web site can also be promoted using the AutoHTML system. While tools such as style sheets provide this from a low-level formatting perspective, AutoHTML adds the ability to control specific content and high-level formatting elements as well. This type of consistency makes it clear to a student the difference between the organization's official pages, and external pages that are merely referenced by the official site. It also reduces the learning curve for a student who has taken other courses from the same organization.

Conclusion

AutoHTML is a work in progress. It still requires additional testing and feature additions. It was developed out of the observation that in our own course web sites similar formats were repeatedly used. As competent HTML users, we had the ability to copy old pages, strip out the content without losing structure and add in new structure and content. Yet, other less competent HTML users were not able to do this, beginning each time from scratch. AutoHTML gives less competent users the ability to re-use the structures already in a web page format.

Future directions for the system include the creation of additional components for error detection during template creation. Currently, merge field names and section name fields must be unique; yet the current system allows ambiguous naming to occur. This situation may cause errors in the operation of the scripts. Another need is automation of multi-document structures. For example, it may be desired to link a newly created page into an existing page which contains links to similar documents of the style, such as a class page which references multiple assignment pages, each of which was built from the same template. A multi-document structure should be developed that will change or add references in other pages. Additional progress and updates on this project will eventually be reported from the authors' web sites at http://cs.nlu.edu/~csci/.

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Building Interaction in Online and Distance Education Courses

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Abstract: Studies have shown that the single greatest factor affecting student satisfaction in distance education courses is the amount of interaction that occurs between teacher and students. New technologies have expanded the potential for interaction between students and instructors, but meaningful interaction that contributes to student growth and learning requires careful planning on the part of the instructor. Two sections of a graduate level instructional technology course delivered via video teleconferencing and online instruction were examined for instructional strategies that were used to build interaction. In addition, the effectiveness of the strategies and student responses to the interaction were explored.

Introduction

The earliest distance education courses, including correspondence, radio, and television broadcast courses, were generally limited in the nature and amount of interaction that occurred between teachers and students. In most cases, the instructional delivery systems supported one-way, asynchronous (non-concurrent) communication. Teachers presented information to students who were isolated receivers of the course content via the mail, or some form of broadcast technology. Student feedback or responses to instructors, if it occurred, depended on return mail, or occasionally the telephone. This introduced an automatic delay into the communication interchange. Interaction between students rarely transpired, because most of the courses were designed to be independent study courses. Students were not aware of, or involved with, other students who might be enrolled in the same class (Moore & Kearsley 1996).

However, the current technology-based distance learning delivery systems, including video and computer conferencing, and other online course delivery options, provide students with a "far richer range of interaction, not only with the instructor, but also with other learners" (Heinich, Molenda, Russell, & Smaldino 1999, p. 277). This capability to provide increased interaction, including two-way, synchronous (concurrent) communication, is critical, since a number of studies have shown that the single greatest factor affecting student satisfaction in distance education courses is the amount of interaction between the teacher and the students (Fulford & Zhang 1993; Furst-Bowie 1997; Zirkin & Sumler 1995). And, as community and peer interaction have grown more important in traditional classrooms, distance educators have also recognized the learning benefits of collaboration and interaction between students in technology-mediated learning environments (Anderson & Garrison 1998; Anderson & Garrison 1995; Brown, Collins & Duguid 1989).

Moore & Kearsley (1996) identify three categories of interaction in distance education settings: learner-content interaction, learner-learner interaction, and learner-instructor interaction. Learner-content interaction refers to student involvement with course materials as they construct their own knowledge by accommodating new information into their existing cognitive structures. Learner-learner interaction includes individual one-one interchanges between students, as well as communication between small or large groups of students for collaboration, clarification, feedback and support. Learner-instructor interaction refers to communication between students and teachers for the purpose of creating and maintaining interest; presenting, clarifying or elaborating information; scaffolding learning; or providing feedback, evaluation, support, and encouragement.

Jonassen, Peck, & Wilson (1999) suggest that one-alone communication, such as individual student engagement with learning resources, can be facilitated in technology-supported learning environments through online databases, journals, and learning activities such as independent inquiry, research, writing, and browsing. One-one communication that occurs between an instructor and student, or two students, can be accommodated through email or one-one online chats. One-many communication can be supported through

list-servs, bulletin boards, and online chats. Video-conferencing offers additional opportunities for one-one and one-many interchanges.

This paper describes how the three types of interaction identified by Moore & Kearsley (1996) were supported in a distance education environment using the technology resources identified by Jonassen, Peck, & Wilson (1999).

Methodology

Two sections of a one-semester graduate level instructional technology issues course were examined for the instructional strategies that were used to build learner-content, learner-learner, and learner-instructor interaction. One section of the course was delivered using video teleconferencing and online technologies, and the other section was delivered completely online. The course was offered at a teaching university in Georgia.

This course was selected because the course framework emphasized Proposition 5 from the National Board for Professional Teaching Standards (1998): Educators are members of learning communities. This suggested that strategies would be employed to support interaction between all class participants including the students and the instructor.

Data sources included the instructional framework and design for each section of the course, as well as the course materials (online web pages, bulletin boards, email, chats, videoconferences) themselves. Student reactions and instructor reflections were gathered throughout the course to provide additional information.

Course Description

The video/online section of the course was delivered using the Georgia Statewide Academic and Medical System (GSAMS) video-conferencing technology and WebCT online courseware. This section of the course met via GSAMS for two and one half hours one week and via WebCT the next week. The second section of the course was delivered completely via WebCT.

The GSAMS system is a compressed video system that supports two-way synchronous audio and video communication between participating sites. WebCT is a web-based courseware system that combines a number of online one-way and two-way asynchronous and synchronous applications including email, private and public bulletin boards, chat rooms, web pages, calendars, and quizzes/surveys. WebCT email supports two-way, asynchronous private communication between individual course participants using a private messaging system. WebCT bulletin boards support two-way, asynchronous communication between all class members (public bulletin boards) or between designated subsets of class members (private bulletin boards). Bulletin boards allow class members to post messages that can be read and responded to by other class members. Both the initial message and all responses are accessible to any class member cleared for access to a particular bulletin board. WebCT chat provides five chat rooms for two-way, synchronous communication between class members. Real-time concurrent dialog and conversations can be conducted in the chat areas. WebCT also provides one-way asynchronous communication support through Instructor Course Notes, Student Presentations, and Calendar web pages. The instructor or students can create and post web pages that communicate content information, class activities, assignments, etc. in these areas. The WebCT quiz/survey application provides a two-way, asynchronous tool for testing or anonymous surveying.

The GSAMS/WebCT class included the home, or originating site, and two remote sites. A total of 25 students participated in this class, although two students eventually dropped the course for medical reasons. The instructor and two students attended the home site, an additional two students attended a remote site approximately 30 miles south of the home site, and the remaining 21 students attended a remote site approximately 60 miles north of the home site. All participants in the class were regular or special ed teachers, media specialists, or instructional technologists in K-12 schools, and several of the participants worked at the same school. Many had taken classes together and were in essence proceeding through their degree programs as a cohort group.

Twenty students were enrolled in the WebCT class. They participated from a variety of locations around the western/northwestern section of the state, but most participated from their individual homes. Class members included K-12 regular or special ed teachers, media specialists, and instructional technologists; and instructional technologists from post-secondary institutions and a technology training center. Only two class members worked at the same institution, and few had taken classes together.

Strategies for Supporting Interaction

The instructor used a four-step process to plan the course. First, course objectives were identified and student evaluation strategies were developed. Major course evaluation components included a self-reflective technology case study based on a daily technology journal each student kept during the course, a Technology Symposium presentation sharing a technology research or implementation project completed during the semester, participation in two class debates, design of a technology diffusion plan, design of a technology integration plan, presentation of a Technology Tip, and participation in all class activities. Readings and additional class activities that supported course objectives were also identified.

After the evaluation components and other class activities had been confirmed, each was analyzed to determine interaction, group, and time requirements. Interaction needs included the type of interaction required: one-way or two-way communication for information access or dissemination, discussion, collaboration, feedback, etc. Group requirements were based on whether the student needed to work alone, with a small group of other learners, with the entire class, or with the instructor. Time considerations encompassed whether the interaction needed to be synchronous or asynchronous. Supporting technologies (GSAMS, email, bulletin board, web pages, chat, etc.) were then selected to match the interaction, group, and time requirements of each evaluation component or activity.

During the implementation phase, the instructor introduced and guided students through each technology application prior to the time they were required to use the technology for a class activity. Students in both classes were required to attend a face-to-face orientation session on campus the first night of class. During this orientation, all students were introduced to and practiced using basic WebCT applications including accessing and printing Course Notes and Student Presentation web pages, sending and receiving email and attachments, reading and posting to the public and private bulletin boards, and participating in an informal chat room conversation. In subsequent online meetings, students were guided through more sophisticated use of the bulletin board and chat technologies through weekly postings on the Course Notes web pages and general bulletin board discussions. GSAMS students also received an orientation to the GSAMS videoconferencing including strategies for effective participation and presentations. Students in both courses were provided access to an online WebCT tutorial, online WebCT help, and a toll-free WebCT help desk telephone number.

Informal evaluation strategies were employed throughout both sections of the course. An Online Woes bulletin board was established to allow students to publicly discuss problems and difficulties they were experiencing in the course. This public forum provided feedback to the instructor about positive and negative student experiences, and enabled students to share frustrations and solutions with each other in regard to the online format. It also allowed them to see that different students experienced and reacted to the same online activities in a different manner. Some formative course adjustments were implemented based on feedback provided via the bulletin board. After each major course activity or evaluation component, students privately emailed the instructor their reflections on the activity or evaluation, how the technology supported the task, and problems/solutions they encountered. At the conclusion of the course, students completed a formal questionnaire concerning their experiences in the distance education course.

Learner-Content Interaction.

Students interacted with course content in a variety of ways, and frequently the interaction with course content also incorporated learner-learner interaction and learner-instructor interaction. In this sense, it is difficult to separate the three types of interaction and overlaps will be described as they occurred.

Students in both sections of the course received a printed syllabus during the orientation meeting. The syllabus outlined objectives, requirements, evaluation activities, and the course schedule of events. In addition, a link to the syllabus was posted on the WebCt course Home Page. A textbook reader was required for the course, but additional materials and readings were accessed through Course Notes web page links to a variety of online full-text periodicals available through the Georgia Library Learning Online (GALILEO) database, as well as other World Wide Web (WWW) resources. Each week, an instructor-developed Course Notes web page was posted on the WebCT course Home Page. The Course Notes web page reviewed the preceding week's activities, announced readings and assignments for the upcoming week, provided links to referenced materials, posted "lecture-type notes", and provided other information to guide students through their weekly activities. This Course Notes web page provided the framework for learner-content interaction.

In addition to required readings, each week one or two different students were required to present a Tech Tip to the rest of the class. The purpose of this activity was to inform students of new ways of using technology, provide troubleshooting tips, or acquaint them with resources with which they might not be familiar. Students presented Tech Tips in one of three ways: they created and posted a web page(s) containing their Tech Tip; they posted their Tech Tip to the Tech Tip bulletin board; or the GSAMS/WebCT students could do a Show and Tell about their Tech Tip on GSAMS. Unless the Tech Tip was presented on GSAMS, students accessed the Tech Tip independently. However, there was frequently a good deal of learner-learner interaction on the bulletin board after each new Tech Tip was presented. Students frequently commented on the helpfulness of the tip, suggested alternative strategies for accomplishing similar objectives, or asked for additional information.

Another major source of learner-content interaction was the Technology Symposium. At the end of the semester, a mini technology conference was hosted by the class. Individual students or small groups of students each selected a technology issue and did a presentation on that topic as part of the Technology Symposium. Some students did research-based presentations, others designed and implemented a project related to the selected issue and then presented the project and its evaluation. The Technology Symposium for the GSAMS/WebCT class was conducted via a GSAMS videoconference, and student presenters posted handouts on the WebCT Student Presentations web pages. Students in the WebCT class developed web sites to share their presentations and posted them in the Student Presentations section of the WebCT course Home Page. For those students working on group presentations, learner-learner interaction was an added component of this activity since the students had to use email, bulletin boards, and chat rooms to coordinate the planning, development, and presentation of their Technology Symposiums. As with the Tech Tips, whole class learner-learner and learner-teacher interaction occurred in bulletin board discussions that followed up on the ideas and experiences shared in the Technology Symposiums. Student reaction to the Technology Symposiums was overwhelmingly positive.

Learner-Learner Interaction.

As described in the Learner-Content interaction section, student interaction with content was frequently followed by spontaneous interaction with other students or the instructor on the bulletin boards. At other times, the instructor designed activities that specifically required learner-learner interaction. The purpose of these activities was to provide the kind of interactive involvement that occurs in class discussions or small group work in traditional classrooms. During the early part of the course, the learner-learner interactions began as instructor-initiated discussions on the bulletin board. Each week, the instructor posted several questions related to the readings, and students responded to and discussed these questions on the bulletin board. Frequently, other issues or topics emerged during these discussions as students posted personal technology problems or shared newly discovered technology resources.

After several weeks of heavy bulletin board activity, students reported (on the Online Woes bulletin board, in their daily Technology Journals, and via personal email to the instructor) that they were overwhelmed and frustrated by the enormous amount of material surfacing on the Weekly Discussion bulletin board. Some had difficulty tracking on-going discussions, and others complained that it took several hours daily to keep up with the bulletin boards. The instructor used several strategies to alleviate these complaints. First, the procedures for tracking ongoing bulletin board threads were reviewed on the Course Notes web pages during the fourth week of class. The time issue was more difficult to resolve since the class was

divided about this problem. Some found the bulletin boards tremendously helpful and wanted them to continue as they were, others just did not have the hours required to handle the volume. To remedy this problem, the instructor divided each class into two sections and assigned students to either Section A or Section B. From that point on, there were two bulletin boards for the Weekly Discussions. Students in Section A were required to participate on the Section A bulletin board, and Section B students participated on the Section B bulletin board. Students could read the other section's bulletin board, but they could not post to it. This cut the amount of required bulletin board reading in half, but still gave aficionados the opportunity to follow the discussions taking place on both bulletin boards.

After students were comfortable with the course structure and the interactive WebCT tools such as email and the bulletin boards, small group projects were assigned. For the first project, students worked in small groups (5 students per group) to design a diffusion plan to support an instructional technology innovation that had been funded statewide in Georgia, but that had failed in the K-12 setting. This assignment followed a two week study of diffusion of innovations, including adoption cycles, adopter categories, attributes that support adoption, etc. The specific technology innovation that the plan focused on was selected as a result of technology adoption concerns that had surfaced on the Weekly Discussion bulletin boards. Group members used email, private bulletin boards, telephone connections, chat rooms, and in a few cases, face to face meetings, to collaboratively develop a diffusion plan. Each group then posted their plan on the WebCt Diffusion bulletin board. Once all plans had been posted, students reviewed and critiqued the other diffusion plans and sent their feedback to the originating group. Finally, students individually emailed the instructor with the changes they would personally make in their original diffusion proposal based on the feedback from other students. Students also voted for the diffusion plan they thought was most likely to succeed. A second small group project activity was implemented later in the course to conclude a several week study on new and emerging technologies, distributed and distance technologies, and strategies for integrating technology into classrooms. This project required groups to design their ideal, technology-supported learning environment and to develop sample lesson plans that would illustrate how teaching and learning would occur in this innovative environment. Students used the same technologies to work collaboratively to complete this task. The GSAMS/WebCT class presented their designs during a GSAMS session, and the WebCT class posted their designs to the bulletin board. Each student was required to read all the designs, and critique them in an email to the instructor. Interestingly, a combination of the diffusion proposals was actually implemented in one school, and one of the technology-supported learning environment projects became the planning framework for a technology magnet school!

Synchronous learner-learner interaction occurred during several online debates that were conducted using the WebCT chat rooms. At the beginning of the technology integration unit, a debate was announced. The debate resolution was: Computer labs should be disassembled and all the computers distributed to individual classrooms. Students divided themselves into small groups (4 or 5 people) and were randomly assigned to an affirmative or negative position. During the next two weeks, groups researched the topic and interviewed teachers, technologists, etc. Groups also interacted via email and private bulletin boards to plan their debate strategies. Prior to the debate, the instructor established a structured point/counterpoint debate format and reviewed the format and general communication protocols with the students. The point/counterpoint format allowed a student for the affirmative to present a point, then a student for the negative was permitted to refute the affirmative point and present a point for the negative. Students were required to post their arguments in small chunks rather than long paragraphs to avoid long time lags. A ... and OVER communications protocol was used to conclude each posted chunk so other participants would know whether the speaker had more to say (...) or was finished (OVER). The initial debate was limited to 30 minutes. Since there were multiple affirmative and negative groups, several separate debates were conducted on the same topic. Following the debate, the instructor posted the debate transcripts on the Course Notes web page. Students read all the transcripts and then forwarded the instructor their personal position on the issue. Each group also submitted a bibliography of resources used to prepare for the debate. A second debate was held a month later. This debate focused on the use of Internet filters in schools. A similar strategy was used, except students were taught to use the private messaging feature in the chat rooms so they could communicate privately with other group members during the debate. The second debate was lengthened to one hour. It included a 15 minute planning time where individual groups met in a private chat area, a 30 minute controlled debate that was identical in format to the first debate, and a 15 minute conclusion where 4 students could

argue concurrently (still using the ... and OVER protocols). Again, final debate transcripts were posted on the Course Notes web page and students submitted bibliographies to the instructor.

Initially, students were apprehensive about the debates and unsure of the chat technology. After the first debate, students were less fearful but some found the chat application to be confusing and chaotic, even with the added structure of the debate protocols (which weren't always followed). However, after the second debate, when students felt comfortable and adept at using the chat technology, they were overwhelmingly positive about the synchronous learner-learner interaction and the activity as a learning experience.

Learner-Instructor Interaction

Many of the learner-instructor interactions have been described in the previous sections. The instructor participated in all the bulletin board discussions, and moderated the online debates. Additional learner-instructor interaction occurred as students used private email to share individual questions and concerns with the instructor. The instructor usually responded to personal email within a 24-hour time period. Students also used email to submit all assignments, including technology journal installments and a concluding personal technology case study. The instructor read and responded to assignments via email, but the heavy volume prevented timely or thorough responses in many cases. Not surprisingly, students responded positively to individual attention when it was available and were frustrated when there was not immediate response and feedback.

Conclusions and Recommendations

Meaningful interaction was achieved in all categories: learner-content, learner-learner, and learner-instructor. This was achieved through the instructor's careful planning of collaborative course activities that were specifically designed to support course objectives. In addition, students were taught to use the interactive technologies (email, bulletin board, chat) before they were required to use them. These skills were reinforced and refined as the course progressed and the students became more proficient in using the technologies. The greatest problem appeared to be the delayed and limited feedback the instructor was able to provide students regarding assignments. With 45 students, the instructor did not have time to respond adequately. In the future, learner-instructor interaction could be improved by limiting class enrollments or providing additional instructor support.

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Use Of Hypertext Collaboration Software For Cooperative Learning, Case Studies, Special Projects

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In this presentation, the author describes how he uses Internet communication to support cooperative learning, case studies, and special projects. Over four years of testing have been completed on an on-line environment (FORUM) that goes beyond simple e-mail messaging to allow student-generated deliverable assignments and products, either as individuals or groups.

Demonstrated here are illustrations of the author's experience with FORUM in several undergraduate courses at Texas A&M. The software has been used to complement instruction in on-site classes as well a course taught via two-way digital televideo. Examples are provided for three kinds of activities: 1) small group discussions and "insight" exercises, 2) scientific journal articles as case studies, and 3) supervision of individual student research projects.

These activities are easier to achieve in FORUM than in browser-based environments because FORUM:

- does not need a Web site or Web-site manager
- does not use third-party Web software such as FrontPage
- is easier to administer than a Web site
- gives better access control and privacy (database cannot be found by browsers)
- lets everybody, not just the Web page creator, create, edit, and link documents

Interactive Video: Reflections on a First Attempt in Off-Campus Course Delivery to Multiple Sites

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Abstract: The lowest common technology denominator in interactive videoconferencing limits public school/university distance education partnerships. This paper presents the realities in the case of teaching special education graduate classes via desktop videoconference to rural, inservice teachers. Instructor delivery modifications must be made in order to facilitate interaction and participants must be prepared to receive their education remotely with some limits on interaction. An evaluation of participant reaction to TCP/IP videoconference delivered education and measurements of their learning are explained.

Introduction

As is the case in many educational settings caught up in the explosion of technology, proposed plans to incorporate technology change nearly as quickly as they are proposed. Our Lady of the Lake University, like many other small, private higher education institutions, is faced with standardizing software, hardware, and communications technologies within its walls. 1997 brought a change in the university presidency, which resulted in a campus-wide reorganization. However, pending the changes in leadership the Education Department found itself without access to high-end, classroom-scale videoconference hardware and connections. Meanwhile, the department was tasked with finding a videoconference solution to meet the needs of a grant designed to increase the number of special education teachers within the region.

The grant the department received was a one-year award to provide graduate-level courses focused on certifying 15 teachers in special education. One facet of the grant emphasized delivering courses to inservice teachers in rural communities so they would not have to drive to campus for every class after teaching all day. In order to accomplish the goals of the short-term grant program the university had to find a multiple-site videoconferencing solution that fit within the grant's technology budget of $2700.

Videoconference Challenges

The university, having discontinued its digital telephone service, no longer had access to H.320 standard (ISDN) videoconferencing. Nevertheless, the rural school districts did not have access to H.320 videoconferencing to begin with. To install, implement and maintain H.320 videoconferencing would have cost the university over $150,000. Local Area Network-based H.323 (LAN) videoconferencing would not work either, since the outlying school districts were not on the OLLU network and the cost to implement that strategy was also prohibitive. The ultimate solution lay in TCP/IP, or Internet-based, videoconferencing.

Consumer-grade Internet videoconferencing is notoriously poor in video quality (max. 10 fps). However, in audio/visual distance education applications, audio quality is more important. Although the audio quality is not up to par with switched-circuit telephony, the quality is good enough that the European Union is grappling with regulating voice over digital circuitry.

Thus, with these hardware and connectivity limitations, we were faced with first finding a technical way to successfully deliver the courses to the remote locations. The next challenge would be modifying the delivery of the class by a professor who was computer literate, but had never participated in distance education of any kind.

Videoconference Solutions

Geography

Inservice teachers from four schools were selected to participate in the program. Seven of the teachers represented two urban San Antonio school districts within close proximity to the university. These students met in a classroom at the university. The remaining eight teachers represented two rural school districts located at least thirty miles from the campus. Four teachers from Marion I.S.D. and four from Floresville I.S.D. met in a room on each of their campuses. Each of these two outlying classes became a remote university classroom.

Hardware

The university classroom and the two remote classrooms were equipped with Pentium class computers that were already on their campuses. Each computer was already outfitted with a sound card and speakers. The grant funds provided each of the three computers with a desktop video camera and microphone. The instructor's microphone was a wireless clip-on, allowing her to move freely around the room. Finally, we used a digital projector in the university classroom to project the computer screen so the participants seated away from the monitor could see. The cost of the new hardware totaled $550.

Connectivity

The university computer was connected by 10Mb Ethernet to a LAN that was ultimately connected to the Internet. The remote computers were also connected to the Internet via LAN; thus no modems were used.

Software

The choice of TCP/IP videoconference software remained to be decided after the hardware and connectivity issues were solved. A variety of companies market their Internet videoconference software as the solution to videoconferencing for education. However, some

solutions aimed at education require a server package costing up to $5000 for the software and licenses. After the initial computer-to-computer testing of four products we settled on NetMeeting, a free program. C-U SeeMe, a popular and well-established TCP/IP videoconference program available free over the Web proved inadequate for audio quality. A start-up company's server-based software proved untested and expensive. Another costly server-based program failed to work properly during the vendor's demonstration and we deemed it too complicated to install and operate if the vendor could not make it work properly.

Delivery

One of the advantages to NetMeeting is the ability to share applications. The professor, having little experience with distance education, relied heavily on PowerPoint to deliver her lectures in a traditional face-to-face situation. In this case though she was able to present the digital presentation to the OLLU campus class and the remote classes would be able to view the same images while participating in the discussion. Likewise, the remote participants were able to save the presentations to their computers for later reference.

Course Modifications

While a few classes had been delivered over a distance by OLLU faculty, none had previously used videoconferencing. One faculty member teaching an asynchronous, web-based class to inservice teachers found the class participants inadequately prepared for the shift in course delivery. In that case the participants had difficulty with the student-centered model requiring independent study and more assertive communication. Likewise, that class had inadequate computer skills, hardware, and connectivity.

A philosophy professor, teaching via the web, found similar difficulties with her undergraduate logic class. She found students unable to cope well with a student-centered model of education and lacking in the initiative required to successfully interact with the instructor and other students, although the opportunities presented themselves.

To prepare the instructor and the participants for synchronous class delivery via videoconference we incorporated the assistance of the university's Instructional Technology Center (ITC). An ITC consultant worked with the professor in the planning of the class. Before the semester started the consultant worked to train the professor in the use of the technology. They also incorporated the use of an e-mail discussion group to facilitate participant collaboration and they set up an Internet site so class documents could be freely accessible to everyone in class, whether remote or local. Together the consultant and the professor modified the syllabus to include a discussion and exercise on the first class day to familiarize the participants with videoconference software and protocol. Meanwhile, the ITC consultant was available online during the first class to answer questions and aid the participants when needed.

The syllabus was also modified to include planned video interaction between the professor and the remote participants, thus not leaving interaction to chance. Planned asynchronous interaction via e-mail was already part of the curriculum. Further, they discussed the issue that interaction is the professor's responsibility. She had to be cognizant of her remote students and make frequent eye contact with the camera, a rather unnatural interaction for a classroom instructor.

Evaluation

Level-one Evaluation

This is an evaluation of the participant's reaction to the class. The participants were surveyed at the beginning of the class to determine their familiarity with computers, videoconferencing, and distance education. They will again be surveyed mid-term to assess their perceptions of the class, allowing the professor to make changes if needed. The participants will be surveyed at the end of class to determine their overall perspective of the distance education model. Finally, daily individual reflections of the participants and the professor are being gathered and assessed.

While this level of evaluation does not objectively measure learning, class improvements can be made for future TCP/IP videoconference classes.

Level-two Evaluation

This is an evaluation of the participant's learning of principles, facts, techniques, and skills as presented in the class. A variety of measures can be used at this level, including tests, skill practice, and simulations. Our evaluation at this level includes tests and quizzes of course content. It also includes a comparison of scores from the videoconference class to those of the same previous non-distance classes.

Summary

Vendors selling products associated with TCP/IP videoconferencing have deemed the delivery of Internet videoconference classes successful. Recently a San Diego State University professor claims to have successfully delivered a geography class to Western Michigan University students via TCP/IP videoconference (Microsoft 1998). However, more use and evaluation is required before it can be widely accepted by institutions of higher education relying on it for the delivery of courses to rural locations. Three primary factors must be considered when implementing such a program: 1) existing and required hardware and connectivity, 2) appropriate and functional videoconferencing software, and 3) modifications in course delivery to meet the limitations of the hardware, connectivity, and software found in each case.

Feedback from this first experience will be crucial in planning for continued use of TCP/IP videoconferencing at Our Lady of the Lake University. Until rural school districts are able to easily tap into high-end ISDN videoconferencing, the available technology of Internet-based videoconferences poses the most accessible option for delivery of courses to rural sites. Thus, we must learn how to make these affordable solutions viable.

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Conclusive results of this study will be available on the web at

Using Serf to Develop Teacher Education Web-Based Courses

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Midwestern State University is beginning to incorporate the use of Serf in its teacher education courses. Serf gives instructors a tool to develop a full web-based course or a web-based component to a course. The latter is how Midwestern State University is implementing Serf.

Instructors are placing their syllabi, course outlines, and readings on the web. Asynchronous discussion forums on various topics, as well as assignment criteria and submissions, are other components being utilized.

Serf also gives the instructor a tool to develop rubrics and permits students to submit papers that are critiqued by the instructor, returned to the student, thus permitting the student to revise the assignment and resubmit for grading.

Using web-based components within a course helps teacher education students become more aware of the power of technology in the teaching/learning process.

Challenges And Considerations When Conducting An Online Course

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Abstract: The rapid technology development makes education no longer confined to a walled classroom. Students may receive academic degrees without stepping on university ground. Currently many faculty members are facing the challenges of conducting on-line courses. The paper reports challenges for conducting on-line courses, including instructional format, methods of instruction, methods of interactions, methods of communication, instructional media, participants, and teamwork. Considerations and suggestions are provided.

1. Introduction

The rapid technology development makes education no longer confined to a walled classroom. Students may receive academic degrees without stepping on university ground. More and more universities are encouraging faculty members to convert traditional courses to on-line courses. Currently many faculty members are facing the challenges of the new educational paradigm.

The paper will report challenges and considerations for conducting an on-line course. It is intended to share the information with instructors of institutions that plan to offer on-line courses. It is hoped that by recognizing and realizing the challenges professionals are better prepared for the electronic learning environment. It is also expected that educators will conduct more dialogue about our education system and the need of on-line courses and will further develop on-line courses of good quality when needed.

2. Challenges and Considerations

In the last decades, educators have constantly developed our educational strategies and methodologies. This development was based on an understanding of instructors and students being able to physically meet each other. However, this scenario is completely different in an on-line course environment. The advance of technology enables a teacher to educate students who are physically separated from him/her; an on-line course is an example.

Instructors are experiencing challenges when conducting an on-line course. Challenges will be discussed, and suggestions will be provided to educators for consideration when conducting an on-line course. However, as we all know, we have more questions than answers, and we are still in the process of solving the problems.

2.1 Instructional Format

In a traditional class, instructional format includes preparation, presentation, application, evaluation, and summary. It is possible to apply these steps to an on-line course. However, it is a challenge to find the right strategies to transfer classroom activities into online activities (Garrison, 1989) without affecting students' concentration, motivation, thought, mastery, and comprehension (Verduin & Clark, 1991). In addition, since a student will be evaluated without the teacher's presence, how can the teacher be sure that the assignments, projects, or tests are really completed by the student himself/herself?

One-hour classroom course materials might take more than three hours to complete if it is conducted in an on-line environment. To maintain students' concentration, the instructor can divide the one-hour classroom materials into several on-line sections. Thus, students can take a break between the sections and remain concentrated. Ideally distance learners are full-time workers with high learning motivation. If an instructor is concerned about the students' work, he/she can require students to be physically present for a final examination or an interview.

2.2 Methods of Instruction

Among the methods of instruction, facilitation is more popular than lecture in higher education. It promotes greater student involvement in the learning process (Brookfield, 1985). However, how can an instructor develop an on-line learning environment that promotes student participation? How can one apply different teaching styles to an electronic instruction to accommodate different student learning styles?

One may consider to frequently coordinate and mediate class activities, which require students to conduct on-line discussion. One can contextualize classroom activities with the real world, for example, by visiting local libraries, observing a class in a public school, or interviewing people in a specific field. It is also helpful to incorporate and integrate several activities into a module. Providing frequent and appropriate recognition of student responses is important.

2.3 Methods of Interactions

Classroom interactions among instructor-students and students-students are essential for successful teaching and learning (Anderson, 1993). On-line discussions, group work, and question-answer sessions can be accomplished by means of both synchronous and asynchronous modes. However, how to maintain students' frequent and consistent involvement, how to encourage student cooperation and collaboration, and how to apply a variety of interaction methods within the capability of specific computer systems and application tools become challenging.

People like to work with friends or with people they know. It would be easier for students to cooperate or collaborate with classmates who they feel comfortable with. Since in an on-line course students do not have to physically meet, it is helpful to conduct on-line ice-breaking activities at the beginning of the course, for example, having students exchange their autobiography. When conducting group activities, the instructor can encourage student cooperation by being a mediator of the group at the beginning and then letting the students take over. As to capacity of computer systems, it is always advisable to conduct a simple and easy presentation that is compatible with most hardware, operating systems, and application tools.

2.4 Methods of Communication

Methods of communication involve visual, verbal, and non-verbal communication. In a traditional classroom, they are readily integrated in the teaching and learning process to express the meanings of actions, words, and texts (James & Blank, 1993). They happen simultaneously as a subject matter is explained in classroom. In an on-line course, teaching materials are delivered electronically. The chances to integrate these three elements (visual, verbal and non-verbal) into one presentation is difficult, although it is possible (Cochenour, 1994). The success of the integration depends on (1) the capability of the system networks to perform the delivery, (2) the capability of the instructor's and students' computers to process the information, (3) the capability of the course management tools and application tools to transfer the data, (4) the ability of the instructor to design and develop the course materials that are suitable for online classes, and (5) time and money that are allocated to develop the course materials.

To overcome some of the challenges, one can consider using resources that are readily available and accessible on the Internet (Ellworth, 1994), for example using free e-mail and free webpage space. It is helpful to ask students to provide information about their computers to their classmates so that every student in the class understands their commonalties and differences. When we frequently use advanced technologies, we tend to forget other existing technologies. Telephone is a tremendous tool for communication. It is advisable to provide a toll free number to the students to communicate with the instructor.

2.5 Instructional Media

Instructional media are usually used as a supplement to enhance learning in a classroom. In an on-line course, the role of technology is significant because it is used to disseminate primary course information (Miller & Clouse, 1993-1994). Nearly all class activities depend on the ability of technology to accommodate a variety of instructional media like video and laser disc. The technological capabilities determine whether or to what extent the media can be used to conduct communication, interaction, and instruction.

As suggested above, one can use available and accessible resources on the Internet. It is suggested that an instructor employ common application tools that are available to all students. In addition, it is recommended that instructors use simple and easy presentation media first and then gradually increase the sophistication of the instructional media.

2.6 Participants

Instructors, students, and guest speakers constitute classroom participants (James & Blank, 1993). In an on-line environment, guest speakers rarely appear. Communication among students is mostly text-based. Without personal contact, facial expressions, and social cues such as gestures and smiles, participants might feel uncomfortable of the text-only electronic communication.

It might not be efficient to invite a guest speaker to communicate with students via synchronous mode. However, it is helpful to have a panel who is willing to discuss issues with students asynchronously. It is also suggested that an instructor conduct the on-line ice-breaking activities mentioned earlier to reduce students' anxiety.

2.7 Team work

An on-line course requires teamwork of faculty members, support staff, administrators, and policy makers. In a university setting, these four team players have very busy schedules and distinct roles. For example, by the sixth year a tenure-track faculty member has to demonstrate outstanding achievements in three areas: research, teaching, and service. Similarly, the other team players have tremendous responsibilities and commitments. To offer an on-line course, the team players have to frequently get together to discuss many issues. For example: Why do we offer an on-line course? Who assesses the need of the on-line course before it gets developed? Are we ready to offer this type of courses? Do we have adequate resources? Are our technology, hardware, and software adequate? Do we have faculty members who are committed to the task? Do we have qualified support staff including technical experts, technicians, instructional designers, and on-line course managers? What policies need to be made or modified? Are we aware of the equipment our end users possess?

Many questions need to be answered before an on-line course is developed. It is not wise to jump to the development without thinking about these questions in detail. An on-line course can turn into a disaster if it is not well planned. It can cause much more damages than a traditional class. It is suggested that a team be designated to the task. The team members should include policy makers, administrators, faculty members (senior faculty preferred), instructional designers, technical experts, technicians, and on-line managers. Since the task is on-going, detailed, and time consuming, the team members should receive release time so that they can devote themselves to the task.

3. Conclusion

The advance of technology is altering our education, and educators are experiencing the shift of new education paradigms. More and more on-line courses have been offered. Challenges of conducting an on-line course include (1) using appropriate instructional format, methods of instruction, methods of interactions, methods of communication, and instructional media, (2) encouraging participants' involvement and responding to their needs, and (3) requiring commitment of key team players: faculty members, support staff, administrators, and policy makers. Some questions have been answered; many problems remain unsolved. Educators are encouraged to share their ideas with their colleagues and continue the debate. With the current technology development, our new education paradigms may be able to serve more people with a variety of needs.

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Are Training Programs for New Distance Instructors on Target?

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Abstract: This study attempted to measure the effectiveness of distance training programs for new distance instructors. Two hundred and thirteen education majors answered a 5-point Likert-type 41-item inventory designed to measure effective distance teaching behaviors on two dimensions: (a) frequency of effective behavior and (b) importance of effective behavior. It was hypothesized that if students' rated importance of an item higher than the frequency of that item then a deficiency might exist for that behavior. This deficiency would be evidence that the training for that distance teaching behavior was not being taught. A two-way within-subjects ANOVA was conducted. Of the 41 items, 14 were rated higher in importance than in frequency. The 14 items were then analyzed using Principal Component Analysis with Varimax rotation which yielded two factors: Effective Learning Methods and Student Guidance. This study suggests that the behaviors of distance instructors may be deficient in these two important dimensions. Implications for training distance instructors are discussed.

In the past few years, distance training programs for new distance instructors and school personnel have increased in number in Georgia in an effort to keep up with the rapid growth in the number of Georgia Statewide Academic and Medical System (GSAMS) sites. The GSAMS Office, university and college distance education trainers, experienced K-12 instructors, and distance consultants have designed and delivered literally hundreds of training programs to interested users. One result of all this activity is each training program has compiled a set of skills and behaviors felt to be important for new distance instructors to learn and exhibit in the distance classroom in order to positively impact student learning.

The types of behaviors training programs are presenting and requiring trainees to demonstrate in distance classrooms should be those that are critical to the job. That is, skills which are specific to distance instruction. (Mc Kenzie, Mims, & Davidson, 1997; Moore & Kearsley, 1996). And it would appear that the degree of importance of selected distance behaviors has not been explored to any great extent in the literature (Mc Kenzie, Kirby, Newbill, Davidson, 1998). In addition, any kind of literature examining the relationship between how frequently any given effective distance behaviors occurs and the degree of its' importance is sparse.

Methodology

Participants

In the winter quarter of 1998, 201 graduate students majoring in education representing three departments at a major southern teaching university participated in the study, resulting in a return rate of 93.9%. The majority of the respondents were female (87.6%).

Instrumentation

The validation instrument for this study was developed through personal observations of distance classes, discussions with experts in the field, participation as a distance instructor and a review of the distance literature. This resulted in a 41-item instrument describing behaviors of distance instructors that was field-tested over a three-year period by Mc Kenzie, Kirby, and Mims. Participants were asked to indicate two dimensions for each item: (a) the frequency each behavior was observed in class and (b) the perceived importance of the behavior. The instrument employed a 5-point Likert-type scale. For the frequency dimension a "5" represented "very frequently" while a "1" represented "never." For the importance dimension, a "5" represented "very important" and a "1" indicated "not important."

Procedure

The validation survey was distributed to six graduate classes in the College of Education. All instructors who taught distance classes winter quarter volunteered to have their students participate in the study. This included one class in the Counseling and Educational Psychology Department, one class in the Middle and Secondary Education Department, and three classes in the Research, Media, and Technology Department. Class size ranged from 98 students to 15 students while the number of remote sites ranged from two to five. Five of the distance instructors were relatively new in teaching through GSAMS. Three instructors had just started teaching distance this quarter, two instructors had taught via GSAMS for two quarters, and one instructor had taught through distance for over three years. not important."

The surveys were distributed to all the distance classes at the end of the quarter, one week before the final exam was given. Packets of surveys were mailed to all the remote sites so that they would arrive in time for class. At the home site the distance instructor distributed the surveys. At the beginning of the second to last class in the quarter the instructor explained the nature of the survey and asked all students to participate in the study. Students were asked to completing the questionnaire by the end of class and mail them back in the postage-paid return envelopes or personally hand them to the instructor. The instructor then gave the completed surveys to the research team for analysis.

Results

The means for the importance dimension of the teaching behaviors ranged from 3.46 to 4.95. Thirty-six of the behaviors had importance means greater than 4.0. The means for the frequency dimension of the teaching behaviors ranged from 3.2 to 4.87. Thirty-three of the behaviors had frequency means greater than 4.0 (see Appendix A).

A two-way within-subjects ANOVA was conducted to evaluate differences between the frequency and importance dimensions on the 41 items. The participant by question interaction effect was statistically significant using the multivariate criterion of Wilks' lambda $(\lambda)\lambda = .321$, $F(40, 110) = 5.812$, $p < .001$. Forty-one paired sample t tests were conducted to follow up the significant interaction. Familywise error rate was controlled using the Holm's sequential Bonferroni approach. Of the 41 items, 14 were rated higher in importance than in frequency.

These 14 items were then analyzed using Principal Component Analysis with varimax rotation, which yielded two interpretable factors, Effective Learning Methods and Student Guidance. The Effective Learning Methods factor accounted for 33.56% of the item variance while the Student Guidance factor accounted for 17.54% of item variance.

Factor 1 (Effective Learning Methods)

Q3. Arranges for materials such as handouts to be delivered to off campus sites as needed (.422)
Q7. Keeps students informed of their expectations including what they are to be doing in class. (.676)
Q13. Clarified assessment methods and expectations to students. (.815)
Q14. Designs effective visual aids for distance education classes. (.695)
Q15. Sets realistic expectations on what can be covered in each distance session. (.795)
Q16. Communicates expertise and knowledge of the class content. (.797)
Q25. Provides class outlines for sessions. (.614)
Q29. Gives immediate and effective feedback, which includes both specific and general praise. (.792)

Q31. Checks the placement and clarity of the visuals on the overhead projector. (.631)

Factor 2 (Student Guidance)

Q1. Develops a backup plan for emergencies. (.459)
Q30. Is aware of students' names at all sites (.697)
Q34. Instructs students on the proper use of the equipment. (.656)
Q39. Checks students' perceptions about their distance experiences. (.648)
Q41. Uses e-mail to send assignments and progress reports to students at all sites. (.732)

Conclusion and Future Directions

This study confirmed that students perceived the 41 teaching behaviors included on the validation instrument as important, and indicated that students believed most of the these behaviors were very important or critical. It also showed that in the participating distance education classrooms, students observed instructors exhibiting all the teaching behaviors sometimes, and observed instructors exhibiting most of the behaviors often or very frequently. This indicated that the training program provided to these new instructors gave them the skills and knowledge required to function adequately in a distance education environment.

The study also suggested that some of the behaviors considered most important by students, particularly those related to effective learning methods and learning guidance, may not be occurring at optimal frequencies in some distance classrooms. However, these findings are not conclusive and need further investigation. While the importance dimension for 14 of the teaching behaviors was rated higher at statistically significant levels than the frequency dimension, the mean frequency of occurrence for most of these behaviors (Q3, Q7, Q13, Q14, Q15, Q16, Q25, Q29, Q31) was still high (greater than 4 on the 5 point Likert-type scale). This suggests that from a practical perspective these behaviors were occurring frequently, but there is no evidence to indicate whether this frequency level was sufficient or optimal.

Additional studies are needed to determine optimal frequencies of performance for each behavior. If optimal performance frequencies can be established for a validated set of important distance teaching behaviors, then this information can be used to establish performance baselines. This would provide valuable scope and sequence information for distance education professionals charged with developing training programs for new distance instructors. It would also establish a framework for evaluating distance education faculty performance and identifying areas for remediation, as well as contributing to evaluation designs for distance education training programs.

Finally, separate studies have been conducted by the researchers to identify the teaching behaviors distance coordinators, distance instructors, and now, distance students believe to be important. The final step in validating a list of effective teaching behaviors will be examining the results of these studies holistically to compare similarities and differences in perceived importance between the three groups of distance education participants. This should result in a final validated list of effective teaching behaviors for distance instructors that can be used to design effective distance training programs.

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Appendix A

Table 1: Effective Teaching Behaviors of Distance Instructors - Importance and Frequency Findings

Behavior Statement The instructor…………………..	Importance Mean	Frequency Mean
1. Has emergency phone numbers for problem solving at sites	4.95	4.22
2. Arranges for materials such as handouts to be delivered to off campus sites as needed	4.85	4.59
3. Communicates expertise and knowledge of the class content	4.78	4.52
4. Clarifies assessment methods and expectations to students	4.78	4.28
5. Uses proper grammar and avoids the use of vulgar and slang expressions	4.68	4.87
6. Establishes cues that are communicated to the students to let them know when the class is beginning and ending	4.67	4.43
7. Is sensitive to students' comments	4.64	4.44
8. Sets realistic expectations on what can be covered in each distance session	4.62	4.24
9. Checks the placement and clarity of the visuals on the overhead projector	4.60	4.34
10. Makes sure students know how to signal and interrupts the instructor when problems develop	4.58	4.35
11. Designs effective visual aids for distance education classes	4.56	4.03
12. Keeps students informed of their expectations including what they are to be doing in class (i.e., listening, taking notes)	4.54	4.25
13. Develops a backup plan for emergencies	4.51	3.21
14. Incorporates time for a variety of activities such as small group discussion, videotapes, the Elmo, etc.	4.49	4.43
15. Gives immediate and effective feedback which includes both specific and general praise	4.48	4.23
16. Looks at students in class at the delivery site and directly into the camera to students at remote sites when making presentations	4.46	4.59
17. Provides class outlines for sessions	4.43	4.08
18. Encourages open dialogue between students (allows alternating responses on and off site)	4.43	4.48
19. Encourages active class participation	4.43	4.54
20. Develops rapport with students	4.43	4.22
21. Uses a variety of teaching modalities such as lectures, discussions, role-playing and hands on learning opportunities whenever possible	4.40	4.23
22. Uses e-mail, the phone, and/or fax when possible	4.40	4.59
23. When called for, uses distance education equipment with care and expertise	4.40	4.21
24. Repeats students' questions for clarity before responding	4.39	4.18
25. Uses humor in class without sarcasm	4.36	4.32
26. Begins class on time	4.36	4.31
27. Varies voice inflection when delivering instruction	4.36	4.27
28. Provides content reviews at the beginning of class, during the session, and at the wrap up	4.34	4.31
29. Utilizes group-processing skills	4.32	4.30
30. Prepares to facilitate discussion between and/or among sites	4.28	4.23
31. Utilizes problem solving exercises such as discussions or written assignments to assess students' progress	4.28	4.27
32. Uses site facilitator to assist with the delivery of class.	4.20	3.99
33. Uses longer "wait time" for responses to questions and comments	4.18	4.27
34. Uses informal assessment techniques such as class participation and observation to assess the degree of success of the course	4.18	4.01
35. Instructs students on the proper use of the equipment	4.13	3.48
36. Checks students' perceptions about their distance experiences	4.06	3.68
37. Uses e-mail to send assignments and progress reports to students at all sites	3.93	3.38
38. Assesses students' prior experiences with distance education	3.73	3.39
39. Is aware of students' names at all cites	3.57	3.20
40. Wears clothing that is complimentary of the learning environment	3.48	4.49
41. Is aware of student movement at all campus sites	3.46	3.20

How to Simplify Involvement in On-line Course Work

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Abstract: After the implementation of on-line capabilities in a Georgia university, faculty were given training sessions on how to design course pages, upload course notes, and maneuver around various icons. During the first year of execution, many trials and errors resulted in more effective time management for both faculty and students. This paper gives procedures by faculty experienced in on-line and distance learning to make student involvement more meaningful.

Introduction

Educators are often quick to "jump on the newest bandwagon" whenever some new concept, gadget, technology program enters the educational scene. Although the use of new techniques may result in greater knowledge, evaluation often indicates that management is costly in time given to preparation and implementation. A major problem for many professors is that in trying to utilize every new strategy offered in their On-line courses often over load the possibilities and overwhelm both themselves and their students. Students, however, must become selective when choosing courses and programs that meet their needs and learning styles. Both the instructors and the students must consider all areas if this experience is to be effective. According to Willis (1993), distance learning not only poses challenges, but it also offers possibilities and strengthens teaching strategies. Although some students complain about the time factors in such courses, most students learn a new appreciation for technology and the possibilities for learning and networking (Saunders, N.G, Malm, L. D. Malone, B.G. Nay, F.W. Oliver, B.E. & Thompson, J.C., 1997). The Council for Higher Education Accreditation has begun to look at assuring quality in Distance Learning. If national and regional associations such as NCATE and associations of schools and colleges are checking on the quality of the programs, then it is important that instructors begin to assess the quality of teaching and the type of preparation for each course of study using distance learning methodologies.

Study

Professors, experienced in teaching On-line courses as a supplement to regular course work or as a total course, distance learning via compressed video known as GSAMS (GA Statewide Academic and Medical System) or in any combination the above offer suggestion for simplifying their involvement and making the experience more meaningful to students. These suggestions range from better use of bulletin boards and forums; effective strategies in writing tests and quizzes for on-line use, and techniques for using GSAMS more manageable. The definitions of the various distance learning programs offered and used at The State University of West Georgia include the following:

Definitions

Distance Learning is education that is delivered over a distance to one or more individuals located in one or more other sites.

GSAMS is a two-way audio and two-way video conferencing system which allows participants to interact live. WEBCT is a tool that facilitates the creation of sophisticated World Wide Web-base educational environments. WebCt not only produces courses for the Web, but also uses Web browsers as the interface for the course-building environment. Aside from facilitating the organization of course material on the web, WebCT also provides a wide variety of tools and features that can be added to a course. Some of the tools used by the researcher include forums used for conferencing, chat rooms for work on group projects, course notes and study guides, the calendar with related web postings, and private mail among the class members.

Combinations of the above allow instructors and students to "see" the instructor via satellite and to respond to assignments on line.

The following lessons learned in each of the instructional methods have simplified Distance Learning for instructors and students.

GSAMS - Lessons Learned

1. Needs assessments should be conducted during the middle of a semester to determine where future remote sites should be located.
2. Instructors should become familiar with students' faces and their names so they can be called by name during class. This can be accomplished by developing an online class roster that includes a photograph of each student and selected demographic information.
3. The first class meeting for all distance classes should take place at the home site. This allows students to meet the instructor, the rest of the class members, and to pick up any needed class materials from the local bookstore. When this is a first GSAMS class, questions answered with demonstration alleviate many concerns. Basic orientation gives students an increased awareness of their responsibilities in a distance classes how to use the various electronic resources and library support provided to distance students. It also gives students a chance to develop personal connections, since they may not see each other again during the course.
4. Remote sites should be limited to five or less, and a cap of 30 students per site seems to increase effective interaction time, and the degree to which the instructor can interact individually with students. Many students become dissatisfied with distance classes that spend a substantial amount of time connecting and waiting for responses to take place at multiple sites. Every effort should be made to have handouts at remote sites in advance of class so that students are not put at a disadvantage.
5. Only instructors who are interested in conducting classes through technologies, have high students ratings in face to face classes, have been adequately trained, and display effective communication skills with students should hold distance learning classes.
6. Student assignments must be clear in the syllabus and discussed again during class time. and include not only the expectations for assignments, but also, how the materials must be submitted (i.e., fax, e-mail, mail, hand delivered) and presented.
7. Materials displayed on the monitor should be easy to read by students at remote sites. A general rule is that no more than six lines of text appear on the screen using 32-point font, and that slides are free from too much informational clutter.
8. An informal evaluation at mid term will determine if needs are being met and what, if any, revisions are needed.
9. A visit to each of the remote sites during the semester allows students to feel more a part of the class and gives them an opportunity to ask questions face to face.
10. Twenty-minute periods of instruction at one time appear optimal. Frequent class interaction times helps students process the information and use it in problem solving situations. Students at the remote sites tire quickly while watching a monitor, thus frequent breaks become important.
11. Evaluation instruments should be different from other evaluation instruments and reflect experiences with technology.
12. All remote sites must be double-checked prior to class by a trained facilitator to make sure equipment is sufficient for the number of students and that the equipment is in working order and available for student use, including the fax machine, if used.

On-line Classes and Student Perceptions - Lessons Learned

1. The first night of class for an on-line course should be held on campus. This provides students with an opportunity to meet each other, cover basics of WebCT and an on-line orientation of the various functions. This immediate practice reduces frustration later.
2. Students should be given other e-mail addresses and phone numbers of support people to contact when problems develop and assistance is needed. Feedback to student questions or assignments should be given within 24 - 48 hours.
3. If the university support staff have full access to the courses, students are often hesitate to participate since they perceive this as "snooping" and a break in the trust between instructors and classmates. A clear understanding of who participants and when should be established.
4. When students do not have home or work access to a computer, they need to know that this course may not be for them unless they are able to be on campus for lab use.
5. Optimal student enrollment for on-line courses is 25 or less at the graduate level. This allows the instructor time to provide individualized assistance. When there is more extensive interaction with on-line functions, the ideal enrollment number is 15 or less.
6. If bulletin boards are utilized, then groups for chat room assignments and/or forum discussions reduces the amount of information each student has to review and process.
7. Students should be informed with specifics regarding the amount, substance, and times required for participation in the online class.
8. Students should be given plenty of notice for on-line participation in chat rooms. Reading course notes and other assignments done in a timely manner, can be done at the student's convenience.
9. Group projects, both small and large are excellent culminating projects and students see the actual results of working on-line.
10. Course content on-line should make use of variety of instructional resources to break up the monotony (especially of "too much textual reading.")

Instructor Training for GSAMS and On-line Classes

1. Instructors interested in any distance instruction should receive extensive training before they begin teaching using the various technologies. Instruction should include effective teaching practices in distance learning, and the design and use effective visuals. Mentors who can assist as needed are invaluable.
2. Handbooks with key information on a variety of topics such as designing visual materials, what to wear, copyright laws, facilitation, emergency operation of equipment, and listings of available resources.
3. Instructors' participation should be considered meritorious and negative course evaluations should not always be considered harmful if students are not experienced in this pedagogy.
4. A reduced teaching load of one class helps instructors adequately prepare for this initial teaching strategy.
5. New instructors should be encouraged to prepare and video a mini lesson before they teach a distance class. A private review of the videotape will eliminate initial concerns and allow mentors to provide feedback before the actual class is taught. Instructors should be encouraged to visit a number of distance classrooms to get a feel for what is going on and how students and the instructor interact with one another.
6. Monthly sessions should be set up for instructors to provide networking, feedback on strategies, and mini sessions for learning and practicing new techniques.

Implications

It is always nice to learn from someone else's mistakes, but when one learns from one's own mistakes, the lessons learned are invaluable. However, knowledge of time constraints and other barriers to effective practices will help future instructors as they begin to use advanced technology and construct web managed courses. All of the suggestions have been designed, tested then re-tested and finally shared for implemented by various instructors. While these strategies appear successful, it is important that all instructors involved with technology continue to find meaningful ways to involve students in their learning.

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Graduate Students On-line: From Anxiety to Bliss

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Abstract: A qualitative study of graduate students' use of the web during on-line courses shows their levels of anxiety as they begin to use technology as a support system for papers, bulletin boards, course notes. Following their conversations and reflections with each other and the instructor provides an in-depth look at their use of computers: the reduction of anxiety and the ease of use that accompanies understanding and practice.

Introduction

Educational leaders are expected to be knowledgeable in several areas including current uses of technology. Futurist Arthur Shostak, of Drexel University, speaks about the "smart houses" of the future and the new approaches to learning that will be common place within the next five to ten years. The computer chips found in today's greeting cards are thrown away when, in fact, only a few years ago the same sized chip was valued for its capabilities in larger machines. Changes in technology, moving from the cumbersome machines, to laptops and then to a more manageable palmtop have come quickly, and how many of us were prepared for the wrist "Dick Tracy" computer made available to the public on June 1, 1998? The truth is that most of our students may be the very first to use these computers, therefore it is important that educators understand the impact of these and other computer types. More important is that curriculum directors and administrators must be able to design curriculum that will complement their use. Most often implementing on-line learning in addition to classroom activities will be part of the solution. An increasing number of colleges and universities are offering on-line distance courses, or courses that use on-line learning as a supplement. Under-graduates seem to take technology in stride, however, many graduate students registering for classes are surprised to learn that many of the activities are on-line; that accessibility to the internet is an integral part of the course, and these graduate students, in particular, are filled with anxiety.

The researcher began teaching on-line courses to students in educational administration in the fall of 1997 using the university's WebCT on-line program. "WebCT is a tool that facilitates the creation of sophisticated World Wide Web-base educational environments. WebCT not only produces courses for the Web, but also uses Web browsers as the interface for the course-building environment. Aside from facilitating the organization of course material on the web, WebCT also provides a wide variety of tools and features that can be added to a course." Some of the tools used by the researcher include forums used for conferencing, chat rooms for work on group projects, course notes and study guides, the calendar with related web postings, and private mail among the class members. Private electronic mail is used to send reflections and to ask questions of classmates without using the bulletin board. While the students are able to track their progress, the instructor is able to track their participation, record grades set up timed quizzes, and most important to check on understanding of concepts taught in class and to monitor their growth in technology.

Problem:

Many teachers still feel uncomfortable using computers for anything other than a word processor. Although schools have computer labs and a great percentage of American classrooms are equipped with several computers; the use of Internet remains, for many educators, a mystery. In some cases, educators received their degrees and certification prior to the extensive use of technology. They have limited experiences using the Internet, and often schools have firewalls set up and faculty, as well as students are restricted in its use. Without home computers and these barriers, it is not surprising that on-line courses increases student anxiety.

Method:

Graduate students in three educational administrative courses: Instructional Supervision, Politics and Policies in Education, and Staff Development were required to answer questions on the bulletin board, enter a forum discussion, send reflective journals by private email, and to take short quizzes on-line. Chat room participation was optional since that usually took place in the evenings and not everyone had access. Data were collected from reflective journals, which review the thought processes of the students. Postings from the main bulletin board and from the forums were also collected and analyzed. For their improvement in using computers for class assignments.

Individuals were selected to follow during the courses and their on-line responses were recorded to show the move from anxiety, fear, and confusion to lengthy comments, the help they gave to other students, and their increased insight regarding the use of technology integrated with other curriculum. The researcher changed the names of the participants and assigned alpha letters to each in order to protect students' identities.

After one year of on-line course work, the researcher found that increased confidence resulted in bulletin boards entries that were nearly unmanageable by the instructor and the students. Other classes were made more manageable by the use of forums. Students were assigned special topics and the requirements included a minimum of three original postings with substance, and three responses, with substance to other classmates. Once he initial anxiety was removed and other concerns for other areas on the site were clarified, students settled in to mentoring each others, giving instant feedback, and carrying on discussions that would not normally occur during regular class because of time constraints. The following excerpts portray some of the anxieties expressed by graduate students.

> **Subject:** Lost
> I have no idea to whom I am sending this! I don't want to "vent".....but for a Computer Science major....well...I am somewhat struggling here.

> **Subject:** Confused
> Now what? Is the name of the forum the topic? Are we to address the broad issue with our feelings or what?

> **Subject:** Still confused
> I think I have learned how to "compose" for this forum but how do I read what is in this forum? If anyone can help me, please send me a private e-mail message. Thanks.

> **Subject:** re: syllabus
> I'm just checking my on-line status. Please respond if you received my message. Hi (C), I got your message when you were testing your system. Congratulations! It works!----(D)

> **Subject:** re: help
> How do I get to the Tutorial?

NEXT STEPS

Once the students felt comfortable with the basic procedures, they began to conquer the forum and bulletin boards. Bulletin board access seemed to be easier than forum access. Comments were, at first procedural and short. With practice, postings become more "user friendly", and students offer each other advice and feedback. The following excerpts depict placement, reflection, feedback and encouragement.

> **Subject:** Change
> I am checking to see if I am in the right place. This topic is very relevant to the schools and a major problem for the administrator if it is the majority of the teachers in a school. (Will write more when I know I am in the right place.)

It wasn't long before (F) began sharing her reflections with the class:

Subject: New perspective
I just finished four days of staff development training and I kept thinking of it in reference to our class discussions and readings, especially in the area of follow up. Our follow up was left open ended and we were asked what/how we would like to have it. Because of our class, I was able to suggest some things that will help make the new information more meaningful and help with follow through. Thanks everyone for sharing your experiences, it's helping my Staff Development to be better than what it would have been.

Subject: Our Speaker on Wednesday

I really enjoyed "Dr. A's" presentation. Our school has over 20 nationalities represented in our student body and I should know about some of the sensitivities that our guest speaker spoke about. We could really use him!

Subject: Reflective Journal
I thought about the topic of clinical supervision all the way home. I really feel that the evaluation instrument that is used would be more beneficial to both teacher and supervisor if the conferences, at least one, were used.

Subject: re: Bad Teachers

I admire your enthusiasm and dedication--you show insights and understandings beyond your years of experience. It takes some educators years before they see the overall picture of the responsibility they have.

Subject: re: Bad Teachers

(G) Thanks for the compliment. It feels good to receive one every now and then (smile). I really appreciate it.

Getting Help

When students needed help, they didn't hesitate to ask fellow classmates. One particular request for help had a run of nine responses - half of them before the instructor.

Help with Edweek [Forum: Main]
Does anyone have the title of the article we are to read for next week in Edweek? If I had the title I could search for it at edweek.com. I can't seem to go back to the Sept 18th issue without this info. Thanks!

132. _______ (Sat, Sep. 26, 1998, 10:24)
133. ________ (Sat, Sep. 26, 1998, 10:35)
134. _________ (Sat, Sep. 26, 1998, 13:34)
149. _________ (Sun, Sep. 27, 1998, 18:58)
153. Instructor (Sun, Sep. 27, 1998, 19:41)
155. _______ (Sun, Sep. 27, 1998, 19:53)
178. _________ (Thu, Oct. 1, 1998, 00:47)
180. ___________ (Thu, Oct. 1, 1998, 07:20)

193. _______________ (Tue, Oct. 6, 1998, 12:30)

Subject: Printing Class Notes
Last week, some mentioned that they had trouble printing the case studies. I did too until I selected "All frames individually" on my print command screen. Maybe this helps someone.

Subject: re: My book
I have lost my textbook! If anyone has found it please bring it to class on Wednesday. Thanks.

Mentoring On-Line

Subject: Direct democracy
I just discovered a web site devoted to tracking voter initiatives. It is info@directdemocracy.com. I checked out a few states. The nature of the initiatives there is so interesting. Most of them, such as the horseflesh act, would probably not have many "informed" decision-makers involved. This whole trend scares me and excites me, too. There is great danger in accepting as the law of the land policies that may not have been analyzed fully.

Subject: platinum rule
I am very likely the last student in the course to take the platinum rule test. But, hey, at least I finally made it onto the net. I am a "socializer" according to the test. I can really agree with certain aspects of the results. The test did put me in the mind of the Myers-Briggs questionnaire but, less time-consuming. The Myers-Briggs was informative and the two measures correlated well. These tests are fun. They really made me think!!!

Subject: re: platinum
Let your friends and family take the Platinum Rule test. My wife was a "Director" just as I am. That explained to me why she likes to direct and give me jobs around the house. The test were fun to take and fairly accurate. See you in class.

Advanced Discussions

Forums were set up in all classes to keep the discussions focused. For example, there were six topics in one class in addition to the main forum. By the time students got into the forums, they were introducing themselves to each other, and they had no difficulty expressing their feelings. In some cases, students even began using page numbers from textbooks as their support. The following comments were taken from the topic forum: "sources of authority"

Subject: member update
I am the EBD teacher working on doctorate. I am in your forum. And I remember you. I look forward to speaking to you soon. P.S. other forum members please check in with us.

Subject: re: How to Begin
I to will be getting my thoughts together and doing a better posting. As I stated in my member update note, I missed classed on last Thursday. Post a note or e-mail me with specifics of our topic and group requirements. Thanks,

Subject: Preferred Source
I'd like to begin a discussion on Sources of Authority by sharing some of my thoughts in this area: Concerning Sources of Authority as outlined in our text and our class. I thought our article, "Teaching and the Balancing of Round Stones," was based on the Professional Authority model as teachers make the decisions based on their values and expertise. It seems to me that site-based management fits the Moral Authority model (what is good for the school, etc.) What do you think?

Subject: Interview of recruitment supervisor
I am interviewing a county supervisor tomorrow on characteristics of an effective teacher and an effective administrator. I am looking forward to learning which source of authority she most follows and plan to question her on which source she thinks is most effective (hopefully it will be the same). Missed you all in class Thursday as I was out. I'd like to set up a chat room time with as many of you as possible. How about Thursday evening at 7:00 in Room 1, providing nobody is using it for another topic. Let me know if you can join me or if we need to adjust the time and day.

Subject: re: Interview of recruitment supervisor
Hi, I plan to join you in the chat room. This will give me an opportunity to interact on the net and get feedback as well. See you, well, read you Thursday :-).

Subject: re: Interview of recruitment supervisor
I'll join you also if I can figure it out. See you Thursday at 7. I'll try to interview my administrators to see which type they are also. What criteria are you going to use?

Implications

The growth these students experienced in the understanding and use of technology should be the norm. It took only 5 weeks for the majority of students to become proficient in on-line use as a supplement to face-to-face classes. Some students became mentors on line to others, and those who had taken courses with on-line work tutored other students and assured hem in class that they would have no problems. After the first course on-line, students informed the instructor that they were addicted. They felt a lose when the course was over, and the need to check the bulletin board, or to chat, network and vent was greater than they thought possible.

Until students, especially at the graduate level and those entering educational administration, can actually experience, on-line learning, they usually will not fully support interactive media or the infusion of technology into the various curriculum. Guidelines for instructional use with an understanding that technology is not the "be all and end all" for curriculum solutions will help the most reluctant participant. However, the more one understands the possibilities, the more inclined one is use the medium wisely. Perhaps there will be school administrators who actually assist in the development of school web pages - important to public relations, and to encourage students as they prepare for the future of a global, diversified world.

Talking On-line: Promoting Student and Understanding Through the Development of On-line Course Discussions

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Abstract: This paper is a report on the use of synchronous chat for the delivery of an on-line portion of a pre-service teacher training course. The specific course content was legal and ethical issues that pertain to the professional development of a teacher. Seventy students participated in this study by engaging in directed discussions over the course material. The discussions were lead by their instructor and continued for a period of four weeks. The chat software used collected and logged all interactions between instructor and students, as well as the interactions between student and student. Data collected was analyzed and used to draw inferences about specific characteristics identifiable to chat, and how to best organize a chat session for optimal student interaction.

Introduction

With the current interest among American universities to deliver many of their courses using distance learning techniques, the Internet has increasingly become the medium of choice for course delivery. From this interest, more colleges of education are offering courses that are a part of their teacher training programs over the Internet, or "on-line" as this type of delivery has become known. As with any medium, the course designer must evaluate both the positive and negative characteristics of the medium in order to know how to use the medium to present the instructional content in a way that promises the highest degree of student success (Ahern, Mize & Burleson, 1998). When using the Internet as a medium for delivery, there are a variety of communication tools that could be used in the distance learning environment, each with their own individual characteristics. The chore for the designer is to decide which tool, or combination of tools, will be the best for a given instructional need.

There are two approaches that course designers tend to use when trying to match a communication tool to the content in an on-line environment. One approach is to use the tool that is most familiar to the designer of the course. With this approach, the designer uses a tool that has been used before, and its use is molded around the task at hand. Little, if any, consideration is given to whether the tool is appropriate for the task desired. The second approach is for the designer to use the tool that is the most recent. This "latest is the greatest" approach again ignores the appropriateness of the tool for the task, but instead makes the assumption that the newer the tool the better (Price, 1996). The problem with either of these approaches stems from a lack of understanding of the nature and use of technology. According to Simon (1996), the goal

is not simply to accomplish the task but to seek the most optimal solution. If we could, we would make our tools fit precisely each task thereby maximizing the possibility of an optimal solution. Given the real world, however we settle for something less than the optimal which Simon calls satisfying. For example, a pliers is not a very good choice for tightening a loose nut; a better choice would be an open-head wrench and finally the best choice, given the nature of the task, would be a boxend or socket wrench. If we do not possess or have available the correct wrench, we will satisfice by sing the pliers to do the job. On-line course developers often satisfice by choosing a tool that is inappropriate for their particular needs due to a lack of understanding of the characteristics of a particular technological tool. In order to help prevent this tendency to satisfice, a course designer must be cognizant of the specific characteristics of a communication tool, and understand how to innovatively utilize the tool to match the educational task

One educational task that is highly recommended for all educational settings, but especially for settings where instruction will be delivered on-line, is interaction. There are basically three types of interaction that can occur in an educational environment: learner-content interaction, learner-instructor interaction, and learner-learner interaction. Learner-content interaction is the process of the learner becoming engaged with the subject content presented for study. Learner-instructor interaction is the degree that the student may seek conformation from the instructor about their understanding of the subject content presented. The instructor does this by giving the learner feedback, providing counsel, support, and encouragement. Learner-learner interaction is where students can engage with one another in order to develop a broader prospective about the subject content by interacting with other students that may not hold the same view of the subject content as their own. It is most desirable for educational settings to involve all three types of interaction if students are to fully be engaged in an educational experience. This is especially important in on-line educational environments (Moore & Kearsley, 1996).

Synchronous chat is an Internet communication tool that can be used to allow multiple individuals to log into an Internet server and exchange real time text messages with one another. Chat would appear to be an excellent choice for building the various interactions desirable in educational settings. An instructor can use chat as a way of maintaining contact with students, discussing assignments, conducting on-line office hours, or even to deliver an on-line lecture. This tool can also be used to allow students to meet with each other for the purpose of discussing and building understanding of the course material. If a course designer or instructor wishes to use this communication tool, what are its strengths and weaknesses, and what methods should be used to encourage optimal interaction by all participants in an on-line course.

The Study

Two main questions were used to guide this inquiry into the use of chat as a component in on-line course development. The first question was: What are the identifiable characteristics of chat as a discussion tool for on-line course development? In other words what are the identifiable strengths and weaknesses to chat? The second question was: How can the characteristics of chat be designed into an on-line course to promote optimal student interaction? With this question it was desired to understand how to minimize the weaknesses of chat and utilized the strengths in such a way that student interaction would be increased in the most positive manner.

This study involved the delivery of an on-line portion of a pre-service teacher training course dealing with legal and ethical issues important to the professional development of the teacher. Chat was used as the tool to carry out discussions about specific course material. Seventy students from three separate course sections participated in the discussions which were organized in such a way that all students were anonymous to all other students involved in the discussion. A random number generator was used to generate user identification numbers. Throughout the discussions, each student was simply known by this identification number. Anonymity was used to make students feel more comfortable about discussing the course content in an open and honest manner. Previous to the first discussion, a demographic survey was taken in order to rate the level of prior computer experience each student had coming into this course. Discussions were conducted over a period of three weeks with each discussion lasting approximately one and one half hours. The discussions were lead by a single instructor who had previously taught other sections of the same course in a more traditional group discussion format. All discussion content was held consistent with that of a face-to-face classroom setting. The on-line discussion was presented by the instructor in a format that presented general discussion questions. It was hoped that the general questions would allow

students the freedom to interact with the material and each other. The chat software collected and logged all interactions by all participants. Data collected was analyzed in three areas, which covered the number of total interactions by all participants, the number of interactions directed to the instructor, to other students, and to the group and the degree to which interactions remained on task as opposed to being simple banter. At the conclusion of the three weeks of discussion, the participants were surveyed as to their satisfaction and perceptions about this experience.

Results

Through the three week period from which observations were made, there were a total of 1614 interactions passed through the chat software. Of this total number of interactions, there were 1248 interactions addressed directly to the instructor in response to the questions presented. There were 193 interactions directed to other students in response to comments made by the particular student. Then finely there were 173 comments directed to the discussion group in general with no direct recipient being evident. Figure 1 illustrates the relationship between the number of interactions respective of recipient group.

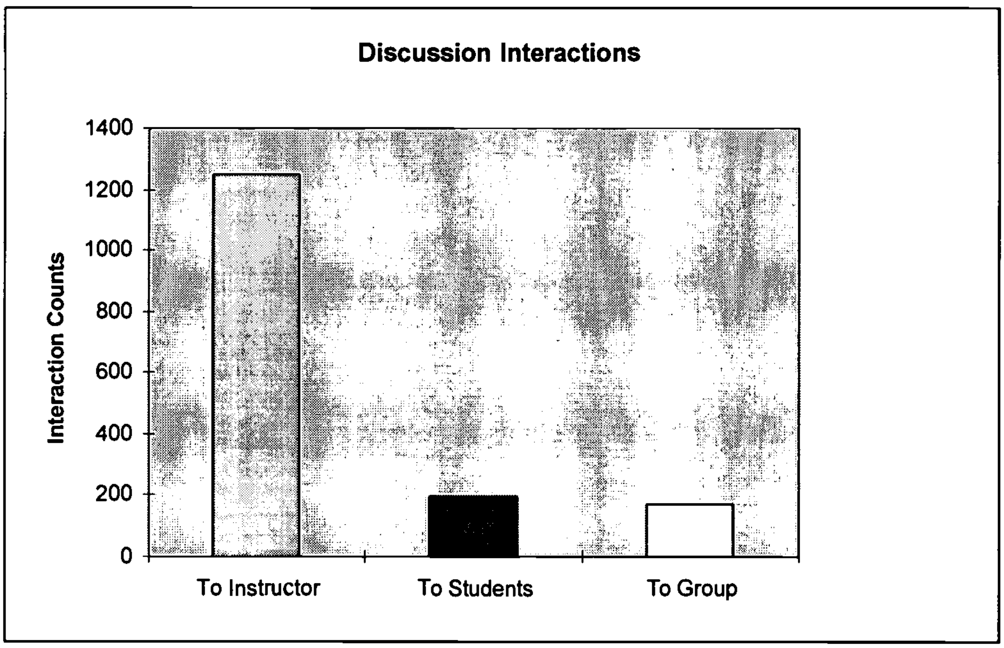

Figure 1

A coded analysis of the amount of interactions that were either on or off task was made that yielded the counts illustrated in Figure 2. Of the total number of interactions, 1441 of the interactions were coded as being directly related to the discussion content. The remaining 173 interactions were coded as being off task and consisted of banter and jokes made in reference to subjects other than that contained in the course content.

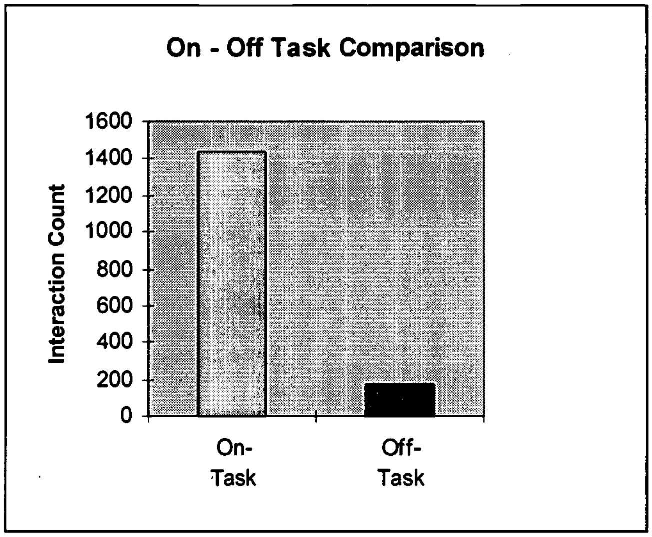

Figure 2

After counts were made of the total interactions, a comparison of the students previous computer experience, satisfaction with this type of discussion delivery and the number of individual interactions for each discussion participant was made. In the comparison of previous computer experience versus number of interactions in these discussions it was found that students with a higher degree of previous computer experience tended to have 63% more interactions than those who had little previous computer experience. This percentage went up to 86% more interactions for students who had not only a higher degree of computer experience but also a higher degree of Internet usage as part of their previous computer experience.

Comparing these trends to the students self reported satisfaction level, it was found as expected that the higher satisfaction level that the students felt with this format, the more interactions the student tended to produce. It should be noted that 92% of the students reported that they enjoyed the experience and would like to try this discussion format again, even among students who reported that they were not totally satisfied with this particular discussion. Specific comments about this type of discussion format by students will be discussed below.

Discussion

This study yields several inferences that are timely given the current state of on-line course delivery. However, it is noted that this study was used simple as a guide to help improve future on-line course development. More detailed and controlled studies are needed to clearly understand the characteristics of chat as a communication tool and its relationship to promoting interaction among students.

Merely using synchronous chat in a on-line course for the purpose of discussion does not ensure that students will actively interact with the discussion material. Students have the opportunity in a on-line environment to choose not to participate or "lurk" in the discussion. To help prevent this several factors should be considered by the on-line course designer/instructor. First the type of questioning is very important. General topic questions put before the discussion group as in this study does not appear to promote interaction by all students. It would seem that it is important to make questions much more specific and direct questions to individual discussion participants instead of to the group in general. The high number of interactions directly to the course instructor would seem to indicate that the type of questions presented were seen by the students not as being for group discussion, but instead simply to answer. An inquiry into group questioning in on-line environments may help explain how to develop both learner-learner interaction and learner-content interaction, not just instructor-learner interaction.

Further, it appears that allowing students to remain anonymous in this type of group discussion also does not encourage student interaction. In this type of discussion where it is part of an on-going course, the use of student identities may have promoted more student accountability, and possibility reduced the number of interactions made that were not related to the discussion content. Of the 173 interactions made not on the

discussion subject, many were inappropriate for a classroom discussion of any type. It is felt that instead of the anonymity of students helping them to feel more comfortable in discussing the subject content thus promoting interaction, the result instead was for some students to use the anonymity to interject disruptive comments while feeling safe that their identities were hidden. This behavior may be reduced if all students had to identify themselves in making comments.

It seems important that the previous computer experience be taken into consideration when chat is being considered for on-line discussions. Students who have a lower degree of computer experience, especially Internet experience, tend not to interact at the same degree as those students with a higher degree of computer experience. A course designer must have some mechanism for determining the variance in the computer experience by the students prior to an on-line course delivery, in order to predict the degree of interaction that should be expected.

Lastly, student satisfaction seemed to reflect the degree of interaction by each student. The more satisfied a student felt with the discussion, the more interactions the student had. Two factors seemed to indicate how satisfied students felt with the chat discussions. One factor involved the way the instructor wrapped up each question. If the students felt they had a strong discussion that brought forth a large variety of views, students indicated that they felt the instructor should closed out each question by indicating the most appropriate answer to each question. With out this conformation about the "right" answers, students felt little closure and were unsure of their understanding of the discussion content. The second factor was the degree of discussion interruptions due to off-task comments made by some students. The general feeling was that this type of behavior hurt the general flow of the discussion and reduced overall student satisfaction with the discussion outcome. As discussed earlier, one way of reducing this problem may be to eliminate students participating anonymously.

Previous research has indicated that there are "fits" and "misfits" in the way that technology is matched to particular educational task (Ahern, 1996) . The main thrust of this study was to help formulate some guidelines for the development of student interaction in on-line courses. Instead of providing answers, this paper has indicated many areas that are in need of additional research in more controlled conditions. Still, the inferences drawn can help point course designers/instructors in a direction that may yield more positive results in regard to student interaction by allowing them to develop a better match between chat and their educational task.

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A Matter of Convenience:
Student Perceptions and Rigor in Web-based Course Delivery

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Abstract: This is a summary of some of the issues that arise in discussions among administrators, faculty, and students involved in on-line course delivery. The Internet is being seen increasingly as a delivery method for many courses, however, not everyone involved with these courses, perceive the courses in the same way. Administrators, faculty, and students seem to have much broader expectations and perceptions about such factors as audience, content, rigor, evaluation, and time. A course that is perceived as a strong course by an administrator may be perceived inferior by the faculty teaching on-line. Likewise, a course that is perceived as rigorous by a faculty member delivering an on-line course may be seen as an unreasonable amount of work by students. This summation looks at some of these differing views.

Introduction

In recent years the popularity of the Internet has continued to grow among the general population around the world. In the United States alone, what was once considered a communication novelty is rapidly being perceived as an educational necessity in many homes. Along with the increased popularity of the Internet, especially the world wide web, many institutions of higher education are rushing to convert an increasing number of courses to online delivery. With the rush to offer courses online, there have arisen questions as to the reasons foe both higher education institutions and their students to desire this type of course delivery. Many of these questions devolve down to a question of the quality versus quantity.

There are many opinions about the correct answers to the questions that arise from the use of the Internet to deliver online courses, just as there are many questions that arise from the use of distance delivery in general. In order to be able to answer these questions, we must have a basis of understanding what students, instructors, and administrations perceive and desire about the use of online course delivery. Many of these perceptions are nothing more than myths or folklore taken from past popular beliefs and science fiction. Others come from a misunderstanding of the perceptions held from the various entity's (students, instructors, and administrators), associated with online course delivery (Moore & Kearsley, 1996).

There are several issues that must be understood in order for a participant in online education to be both satisfied and successful in the online environment. One of the main issues is the perception of access held by the different participants in an online environment. In countries other than the United States, the

research in the field of distance learning is spoken of in terms of opportunity. In areas of the world were the physical distance removes the opportunity for a student to participate in higher education, distance education techniques can be used to provide an opportunity that otherwise could not exist. The use of online courses are one way to provide this educational opportunity.

In the United States we find a different perception about access. In a large number of the higher education institutions that offer online courses, as many as 80% of the students are less than a 20 minute commute to the campus (Thompson, 1998). These students already have an opportunity to take the courses, but opt to take their courses online instead. In surveys conducted among these students, the reoccurring thyme as to why they chose the online courses over traditional courses is convenience. To these students the online course should provide the convenience for them to maintain their various roles of worker parent, and civic volunteer, while at the same time adding the role of student.

Varying Views

In order to appropriately design a course for online delivery, the instructional designer must consider several factors that stem from the various perceptions about access. Factors such as audience, content, rigor, evaluation, and time, all must be considered and designed for in order for an online course to be perceived as successful.

Audience is interesting in the way it is perceived by those associated with on-line learning. Many administrators tend to look at the audience for on-line courses as being new technologically proficient students who are coming to the course from places geographically separate from the area in which the university exists. This audience will increase the student population by bringing in students from outside of the universities standard service area. This audience will be easy to server since traditional student services will not be needed, and will be served at a lower cost to both the student and the university. Students are expected to be successful and satisfied with these courses since they will have the opportunity to structure the course to meet their individual needs. Questions as to content, rigor, and evaluation are generally left up to course instructors, but are considered to be at least of the same quality of that of traditional classroom instruction, if not of higher quality.

Faculty may see this audience in many of the same ways but also must determine how to structure the educational experience so that it allows the students to become apart of the course discipline that the course content is drawn from. A faculty member may evaluate the time a student may spend in a traditional classroom for an equivalent course, add to it time that should be spent outside of class, and then in some cases, add a little extra due to the student not having to physically drive to a campus based classroom. Faculty may see these students as being able to connect to the on-line course and go right to work with the course materials. Often faculty do not consider that the environment that the student may be taking the course in may not be the optimal environment for student success. Also, as student work begins to be turned in, sometimes at a level below the standard expected, the instructor may feel that the rigor of the course is being challenged and therefore try to compensate by adding additional work.

Students themselves often may see themselves as being somewhat timid with the technology needed for a particular class. Still, these students may see themselves as not having the time to make traditional classroom courses, especially since many of these students wish to manipulate their course schedule around work or family obligations. Some students feel that the on-line courses may be easier than a campus delivery due a perception about having to only interact with course content, not with the instructor. Students who have done poorly with a particular class may feel that removing the professor out of the loop will in some why help them pass the course. In this case, students who may not have the strongest work ethic may be enrolled in courses require a stronger work ethic than they may currently have. With all cases, it is easy for the student to become overextended in their time and commitment to the course. This can lead to a situation where students feel that are performing too much work for the credit earned in the course.

Final Thoughts

It has been said that perception often becomes reality. In the context of on-line course delivery, a persons perception about this type of delivery can directly shape the satisfaction and performance in the

course. Whether administrators, teachers, or students, they will approach and judge a course based upon their perceptions about what the course should be. If administrators feel that the student population will increase and then ultimately it does not, they may feel that on-line course delivery is a failure. Or if students begin to drop out of a course because it requires more time then students expected, administrators may feel that faculty expectations may be too high. On the other hand, faculty may feel that they are being forced to water down the rigor of their courses in order to facilitate the on-line environment.

There are no easy answers to the many questions that are associated with on-line course delivery. Still it is important that we understand that many different people who become involved in on-line learning do so for many different reasons. By understanding these reasons, we can design courses in a manner that can facilitate our own satisfaction with the courses we design as well as the success of our students. Understanding the perceptions of administrators, faculty, and students comes from asking questions. It cannot be assumed that everyone's feelings about the on-line environment is the same as our own. Also, as we design a course for on-line delivery, share your views about how the course has been formulated as well as your expectation in the areas of content, rigor, evaluation, and time. In this way some of the misperceptions about on-line courses may be diminished, and real on-line educational experiences may be achieved instead of being seen as being simply matters of convenience.

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Tips for Course Conversion to the Web

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Abstract: There is a virtual explosion occurring in the number of faculty at all levels who are converting courses or creating new courses for delivery via the World Wide Web. Some faculty are fortunate enough to have professional instructional design assistance to complete this process, but many are attempting to meet increasing student demand for technology-delivered courses by focusing on developing their skills with the technology; resulting in a focus on the technology instead of the learner and/or the content. This paper provides quick tips related to learner analysis, adult learners, motivation, capabilities and limitations of the Web, online learning research, instructional strategies, encouraging collaboration, and typical redesign questions related to the development of online instruction.

Introduction

The pressures to provide alternative delivery of instruction, particularly within post-secondary settings, are emerging from a variety of constituencies. Changing demographics within higher education, increased requirements for a perpetually re-tooled workforce, fiscal and political accountability, access to digital infrastructures, and cultural shifts within the Academy are representative of the forces that are moving many faculty to convert their course(s) from traditional face-to-face instruction to Web-based instruction. Hill (1997) writes, "The Web is a technology that has clear potential for creating a learning-centered environment, bridging gaps between distance learning and traditional learning environments. As the educational use of Web-based technologies becomes widespread, distinctions between distance education and classroom-based education may become less apparent" (p. 79). This paper provides a number of specific tips for faculty related to creating effective *instructional* Web environments focused on improved teaching and active learning.

Tip #1

Consider the previous online experience of the learners. Web-based environments present a variety of potential frustrations for the learner directly related to the hardware and software technologies. Since Web courses are relatively new to the instructional scene, many learners take for granted that the technologies will be transparent. These learners may have inadequate vocabulary to articulate the technical problem once they realize it exists. Frustrations that develop not related to the instruction per se can contribute to feelings of learner isolation. Suggestions for ameliorating this potential problem include: (a) use these learner experiences to build community with the other students (e.g., "We're all in this together!"); and (b) provide day and night access to a qualified technical support staff.

Tip #2

Take advantage of the Web-based technology. Online instructional environments can be designed to structure peer-to-peer interactions that would not be possible in traditional face-to-face environments due to constraints of time and place. The Web makes fast responses possible and, increasingly, expected. Faculty mentoring and guiding of discussions can be qualitatively enhanced with this technology that allows for group or individualized interaction. Though not physical, this asynchronous, place-independent medium allows increased functional access to the instructor.

Tip #3

Incorporate basic principles of adult instructional environments in the design of your Web-based course. Even though the learners may not be adults in online courses, the need is substantial for online learners to demonstrate the independent learning skills and characteristics more often associated with adult learners. Knowles (1980) addresses a variety of elements for incorporation within adult learning environments; the most relevant to online instruction include: (a) develop a task-centered or problem-centered approach to the instruction; (b) recognize that adults become ready to learn when they have a need to know; (c) provide opportunities for the learner to be self-directed; (d) content relevance is important and should be openly addressed; and (e) understand that learners are motivated by both intrinsic and extrinsic factors.

Tip #4

Capitalize on the capabilities and design around the limitations of Web-based environments. The Web developed out of the use of the Internet for communication. Begin your course with an emphasis on using the Web for communication and gradually move toward use of the Web for research. Clearly articulate the class structure for the learners (e.g., class, cohort, individual). Define expectations for participation, assignments, activities, and assessments well in advance and in significant detail. Provide visual support within the environment. Develop and scaffold high levels of interaction. Provide quick feedback. Incorporate collaborative activities to encourage active engagement and discourage feelings of isolation. Vary the instructional strategies and assessment techniques. Integrate both asynchronous and real-time activities. Encourage the use of outside resources; especially textbooks and readings that are not online. Be aware of the currently unstable, relatively untested, but evolving, status of copyright law for the Web.

Tip #5

Know the foundational research related to online learning environments. Learners in online courses have time to formulate ideas and contribute higher quality responses than in traditional classrooms. Group interaction is a motivating factor for online learners. Online instructional environments often result in more active peer-to-peer discussion and exchange than in traditional classrooms. Learners in Web-based environments work harder and produce higher quality work. While there are a multitude of citations for these statements, in particular, see Harasim (1993) and Khan's (1997) edited work.

Tip #6

Be creative and flexible with instructional strategies in Web-based environments. Here are ten options for varying the instructional strategy: 1) instructor-led discussion (synchronous or asynchronous); 2) case studies; 3) demonstration; 4) tutorial; 5) facilitation of small group discussions by the instructor or students; 6) simulation; 7) online peer review or critique; 8) problem-solving exercises; 9) group writing projects; and 10) collaborative research.

Tip #7

Encourage and design for collaboration within your Web-based course. There are a number of strategies for facilitating such collaboration. Consider involving colleagues from other institutions or involving professionals from outside higher education in the delivery of content. Post electronic office hours and be online on time. Create activities that force learner cooperation *and* make effective use of the technologies. For instance, there are examples in the literature of "ask the expert" experiences, team simulation competitions, collaborative writing exercises, cohort-developed summary papers, and small group literature reviews.

Tip #8

Ask yourself these fundamental redesign questions. What are the course objectives? What are the anticipated learner characteristics? What can be learned by discovery and what must/should be scaffolded? What can be learned via peer interaction and collaboration? What instructional strategies and media allow me to meet these requirements? Does technology exist that would eliminate or alter this activity? What are the anticipated differences in my feedback to online learners? How do I mentor and monitor active student engagement? What types of assessment are most appropriate--for the content, the learners, the environment? What provisions are in place for formative and summative course evaluation?

Conclusion

To teach a Web-based course requires substantially more faculty time, both in advance preparation for 'class' and during delivery. The creation and implementation of effective Web-based instructional environments requires significant changes in pedagogy to meet online learner needs. While it can be argued that *all* instructional environments are complex and unique, the significant contemporary pressures on faculty to prepare Web-based courses with little or no training or support portends a potentially dangerous result. We must stay focused on using the Web and other technological innovations to improve teaching and learning.

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A Transactional View of Interactive On line Class Components

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Abstract:

This descriptive study investigates issues related to graduate students' use of instructor created Web sites in two teacher education literacy classes. It examines the experiences of these students as they used an on-line component of a course to identify issues of design, implementation, and motivation from a users' perspective. Commonalities exited in the many aspects of the use of the sites but there were some essential differences between the experiences of the two classes.

Increasingly, teacher educators recognize the importance of including technology in their courses. Advances in the technology of communication and the access to such technology have afforded educators new opportunities to incorporate multiple dimensions of technology within their courses. Distance learning courses have been incorporated into many programs in the hope that they will improve student access, increase student involvement and facilitate learning. Too, universities are hopeful that the integration of distance learning courses will increase their enrollment. The challenge is to balance these desires while at the same time ensuring that the quality and integrity of courses are maintained. Teacher educators have a dual responsibility in that they are responsible for not only the content of their university courses, but also the preparation of teachers who will perhaps incorporate distance learning elements within their school settings.

University faculty need to immerse, model and demonstrate technology in classrooms if teacher education programs are to prepare pre-service and in-service teachers effectively. Technology affords teachers multiple opportunities to create communities of learners, to foster instruction and meet the diverse needs of learners. Alternative modes of instruction such as distance learning experiences can provide students with multiple opportunities and vehicles for responses to varied aspects of a curriculum.

Distance learning experiences can facilitate a constuctivist approach to education. Teacher educators are increasingly taking advantage of technological innovations by creating on-line sites for their classes (Quigley, 1994; Dringus, 1995; Young, 1995). Researchers such as Hillman, Willis and Gunawardena, 1994 and Hackman and Walker, 1995 have identified problems related to lack of interaction when such sites are used only for the posting of informational items. The inclusion of an interactive component was, therefore, a key element in the design of the two literacy courses studied.

Purpose

The purpose of this descriptive study was to investigate issues relating to graduate students' use of an instructor created Web sites and to examine the experiences of these students as they used an on-line component of a course to identify issues of design, implementation, and motivation from a users' perspective. In this paper, two literacy educators both of whom work with pre-service and in-service teachers describe their experiences in implementing varying degrees of distance learning in their courses. This study explores the observations and recommendations of the faculty members and the pre and in-service teachers. During the process of teaching the courses, the instructors and the students continually reflected on their experiences using tape recorded interviews and written reflections.

Context and Participants:

Forty-four students were involved in this study, all attend a University in a major Metropolitan city. In both courses, we included the use of an interactive web site. A separate web site set up for each class. The sites were the same and included an area for class conferencing, posting of assignments, sending and retrieving messages, documents, and the sharing of links. Each site held hundreds of messages, conference topics and links and were read by all members of each class exclusively. Participants were encouraged to add new links, start new conference topics and discussions, post questions, respond to others or read new material posted by the professor. None of these graduate students had taken any previous computer courses.

Method:

Formative and summative data was gathered through in-depth interviews and analysis of written comments. Two individuals who are experts in literacy education analyzed the data separately. Following this the researchers shared the themes that each had documented. While differences emerged in the titles of the themes, the ideas were the same. Themes included issues related to student anxiety; trust; reflective teaching and learning and issues of technology.

Discussion:

The following section briefly details the experiences of each of the University instructors and their students' experiences with the incorporation of an interactive web site for their classes.

Class L

This class, consisted primarily of in-service teachers seeking a Master's Degree. The majority of the students had completed their undergraduate studies within the past three years. There were twenty females and one male in the class. The use of the web site was demonstrated in class. Within two weeks, it became evident that the demonstration was insufficient and a two

hour long, hands on, session was arranged. Again, we showed students the web site and, this time, we gave them time to practice using the web site to complete an assignment. Even so, there were still students who were unable to "get the web site to work." The greatest number of replies were given to the "link-sharing" site and most of those replies concerned the posting of sites where lesson plans were available.

There were sporadic responses to the posted questions, in spite of much prompting. There was almost no piggybacking on previous postings. There was no grade associated with the assignment and the students thus seemed to see it as peripheral to the course. The few "older" students (more than thirty-five years old), none of whom owned computers, used the site consistently. The students who are the traditional aged (between twenty-two and thirty years old) Masters Degree population did not. They offered a series of reasons ranging from "I don't have a computer and the lab is too crowded" to "I don't have a computer and I work too many hours to get to the lab."

Class C

The other class, a pre-service graduate class, was similar in size. The students were all "career changers" who were seeking a post-baccalaureate Master's Degree. Nearly all of the students had completed their undergraduate work more than seven years before enrollment in this course; some as many as twenty years. None of the students had taken any computer classes although four students, all male, reported a high level of comfort with the use of computers and concomitant technology. Three students indicated that they were "panicked" at the thought of having to use a computer. Two of those students categorized themselves as "technophobes."

Initially, the use of the interactive web site was modeled by the professor on a projection screen. While it appeared that the students understood the mechanics of negotiating the site, it subsequently became evident that this was not so. About five students were able to access the site. The remaining students reported either discomfort about navigating the site or a total inability to connect. Special sessions were set up where the instructor worked individually with the students. Within two weeks, all students were able to access the site and all had utilized at least one element of interactivity. During this initial phase, we asked students to reflect on their experiences.

As the semester progressed, the students continued to reflect on their experiences. Most even did so on-line. Those who had initially felt intimidated by the technological aspects of the course, felt less so. Many reported that they felt extremely comfortable and were excited about their new expertise.

Findings and Conclusions:

Interactive web sites and distance learning environments can provide powerful additions to classes. It has been reported that less than 5 percent of teachers are actively engaged in the use of these resources and those who are, tend to be teachers who are very experienced with computers overall. While several similar patterns emerged between the two classes, there were

some essential differences between the experiences of the two classes. The similarities support those of other studies in that students took increased responsibility for their learning (Wizer & Beck 1996), they reported decreased feelings of isolation (Casey & Vogt, 1994); and they built a virtual community for support and collaboration (Casey & Vogt, 1994; Hoover, 1994).

Particularly for the Class L it appeared that many students did not seem to take any assignment seriously unless there was a grade attached to it. This was true for only a few of the post-baccalaureate graduate students. Therefore, we recommend that there be a participation grade associated with web sharing experiences. While partner sharing seemed to work well, we felt that interaction might be better facilitated if students were given the opportunity to select their own partners. In both cases, it was felt that we should give instruction in use of the web site early in the semester with students being instructed to bring questions that they would post and respond to during the practice session.

As in other studies (Casey & Vogt, 1994; Hoover, 1994), a camaraderie and support system developed among the students in the course. Many of them continue to support each other in a variety of ways and actively collaborate. These experiences allowed the graduate education students to become immersed in study as a group and to internalize their own models of collaborative learning supported by telecommunications.

Educational Importance and Implications

Research on the efficacy of integration of technology within traditional classroom settings is in its infancy. Technology is changing the way we learn, the way we interact and the way we teach. Pre-service teacher education students will need to incorporate technology in their teaching practices. Teacher education programs need to provide students with varied and numerous experiences that immerse them in technology and its uses. By studying the impact of technology within teacher education classes, we may gain valuable information that will enable us better to facilitate our students' transactions with technology. During this reflective process, numerous questions emerged which will be considered in future endeavors:

In what ways does the role of the teacher change or differ from that in a more traditional course?
What role should the teacher play in facilitating the use of technology?
What is the students' level of engagement with the technology?
Are there age or gender disparities in the use of technology?
How can students and teachers best incorporate aspects of telecommunications?

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Matching Course Needs and Distance Learning Formats: Evolving Guidelines for Planning, Design, and Delivery

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Abstract: During the past five years, College of Education faculty at the State University of West Georgia have used various combinations of interactive audio/video, online, face-to-face, and hands-on formats to deliver preservice and inservice media and technology courses. These experiences have resulted in several successful course models, as well as specific, useful guidelines to help in selecting and developing strategies for: delivering information, fostering student interaction, evaluating student performance, and motivating students. This paper describes three such course models and the teaching/learning activities accomplished with each of the strategies used in them. In addition, the authors present and describe some of the specific guidelines faculty use to assure that distance learning courses are effective, both in terms of accomplishing course goals and objectives and in meeting the learning needs of students.

Introduction

Faculty at the State University of West Georgia's College of Education have been using Distance Learning (DL) technologies for the past five years, and college-wide use of this strategy for course delivery has been increasing steadily. At this time, approximately 55 courses are being offered via two different systems: a statewide two-way interactive audio/video technology called the Georgia Statewide Academic and Medical System (GSAMS), and the online web course delivery system WebCT, a popular web-based course resource developed at the University of British Columbia to provide a variety of course tools and features for the instructor and students. Some courses are primarily GSAMS or WebCT; others use combinations of the two in a variety of ways; and some are in addition to face-to-face or hands-on formats. Faculty experiences with these systems have yielded a wealth of information and guidelines for which kinds of courses and content benefit from each type of delivery system and for ways of optimizing the unique capabilities of each. This paper and presentation will discuss and demonstrate:

- Three distance learning course models currently being offered successfully at the UWG College of Education; and
- Guidelines we have derived for planning, design, and delivering all types of DL Courses.

Three Course Models

Model #1: Combination Interactive Video and WebCT – Instructional Design

This course covers introductory concepts in using a systems approach to designing instruction and is aimed at masters and specialists levels of graduate students in the Media and Instructional Technology tracks. Students meet in the GSAMS classrooms every other week, and do WebCT assignments in the alternate weeks. Faculty find that the interactive GSAMS format works well for lecture/demonstrations and small group practice activities, while the WebCT capabilities make it possible for students to see each others' products and learn from a variety of examples other than their own or those in the textbook. Activities are described here.

- ***GSAMS Sessions.*** The instructor introduces topics, goes over questions from assigned readings, discusses any difficulties students are having, and does whole class and small group example exercises.
- ***WebCT Bulletin Boards***. Students use this feature to post their draft design products and exchange critiques on them. The instructor also posts critiques of the students' draft products.
- ***WebCT E-mail***. With this WebCT feature, students can send their answers to questions on readings and their draft products. Also, they can communicate privately with the instructor about issues and problems peculiar to their design project.
- ***WebCT Chatroom.*** Students and faculty find this a lively and helpful forum for exam reviews and small group conversations about course issues and assignments.
- ***Offline Activities.*** Students are required to do readings and develop a design product. They share their final products in a GSAMS presentation at the end of the course.

Model #2: Combination GSAMS, WebCT, and Hands-on Computer Activities – Instructional Technology

This survey course is required for graduate students in the media program and covers various advanced technology concepts and design/development skills. Hands-on learning is a must for acquiring the technology skills, but many of the demonstrations can be done effectively with interactive GSAMS sessions. The WebCT capabilities support the presentation of text information and self-paced learning; encourage communications among the class, the instructor, and outside speakers; and allow innovative approaches to learning.

- ***Hands-on Activities***. In the university labs, students do media/equipment operation, develop multimedia presentations, use concept mapping software, and practice their desktop publishing.
- ***GSAMS Activities***. Distance learning concepts are covered in an interactive an audio/video environment.
- ***WebCT course content***. In this format, the instructor presents copyright concepts; instructional design principles; and basic media, selection, utilization, and evaluation concepts. Students become acquainted with a variety of resources through self-paced learning.
- ***WebCT Chatroom.*** Students interact with outside resource people and engage in online debates on assigned topics.
- ***Offline Activities***. Outside the classroom and online format, students carry out an actual K-12 school-based project focusing on an aspect of instructional technology.

Model #3: WebCT-based Course – Online Searching and Retrieval

This course teaches online resources, online search strategies, and issues such as Acceptable Use Policy (AUP) and online/multimedia copyright. Since much of the content and skills require reading, analyzing, and responding to summaries, this course is an ideal match for a totally online format. It is structured in the

following manner:

- ***WebCT E-mail***. Students use e-mail to exchange questions, comments, and observations with the instructor and send their completed assignments and exercises.

- ***WebCT Course Content***. WebCT documents are used to present a variety of textual information on content topics and to document and summarize important principles and rules of online searching. Also, students participate in various projects for practice and reinforcement of the skills they acquire in various modules.

- ***WebCT Bulletin Board***. Students post work on the Bulletin Board for others to critique, and interact with each other about issues covered in the course.

- ***WebCT Chatroom***. Using the chat rooms, the instructor arranges for experts in the field to interact with students in a question-answer format.

- ***WebCT Glossary***. Student use this feature to locate and study definitions of terms related to online search and retrieval.

Guidelines Derived for Planning, Design, and Delivery of DL Courses

Through our experiences with these and other courses and formats, we have developed some practical, useful design guidelines for selecting and developing strategies for delivering information, fostering student interaction, evaluating student performance, and motivating students. Many of these guidelines have come about as solutions to problems we have encountered using the various DL formats. Some of the most useful strategies we have developed are those for decreasing psychological distance in the context of all these course formats (Wolcott 1996). Some of the most critical of these guidelines and strategies are described here.

Selecting and Developing Strategies for Supporting Learning

- ***Start Slowly with New Technology Resources***. For students new to DL formats, do simple-to-complex procedures, introduce one format at a time. Make sure they know how to use the technologies (e. g., the college or university online library catalog) before requiring an evaluated product. Encourage practice sessions before actual activities or testing sessions.

- ***Match DL Model to the Type of Course Content.*** As mentioned before, some courses require face-to-face interaction or hands-on practice; others lend themselves to an online mode. Analyze course content to determine which format is optimal. When feasible (in terms of content and student access), use a DL format, which expands the number of students the course is able to serve.

- ***Add Face-to-face When Needed.*** When a concept presents particular difficulties and/or if students begin to feel frustrated about an assignment, take measures to meet personally with individuals, small groups, or the whole class. Sometimes this means scheduling an additional GSAMS session; in other cases, instructors schedule trips to the off-campus sites.

- ***Summarize Course Events and Session Outcomes Online***. After a chat session or Bulletin Board threaded activity, the instructor and/or students summarize key points and what they learned in the activity. These summaries then are posted to the Bulletin Board.

- ***Match the Online Format to the Type of Learning Activity***. Use chats for building consensus, clarifying issues and questions, collaborating on projects and issues, and obtaining input from experts. Use BB for reflective activities such as position statements or critiques of readings or student products. Use e-mail for individual feedback on work.

Selecting and Developing Strategies for Managing Course Delivery

- ***Place Written Communications Online Whenever Possible.*** In addition to course handouts such as the syllabus and exercises, it is helpful to place high points and important topics that came up in class each meeting. Develop edited transcripts of online chats and post them on the bulletin board.

- ***Develop and Document Class Rules and Guidelines.*** The most effective class rules are those students develop themselves. A first class activities might be to have students collaborate on which procedures everyone will follow, then document them for everyone to see.

- ***Use Strategies to Help Students Pace Themselves.*** This strategy is especially useful and necessary for totally online courses. The instructor provides "checkpoints" for where students should be at a given time in the semester/term, e. g., "At this time, you should be working on..."

- ***Include Several Possible Ways for Getting Help.*** When students get frustrated with technical issues or library resources, there should be several ways they can get help (e. g., not just the instructor). That way, immediate help is always available. Be sure to provide e-mail addresses and telephone numbers of help desk staff or other technical support staff, including librarians.

- ***Limit Ways of Submitting Student Products.*** Though students appreciate having a number of options for submitting assignments, this can present logistical headaches for instructors and interfere with efficient assessment. It decreases management problems substantially if students are limited to one or two options.

Fostering Teacher-Student and Student-Student Interaction

- ***Provide a Face-to-Face Meeting during The First Class Session.*** If at all possible, the first class face-to-face meeting, which serves as acquaintance session and class orientation, should take place at a central location (All UWG courses provide this).

- ***Include Getting Acquainted Games or Exercises.*** Since students are separated physically, it is helpful to get them communicating with one another. Instructors may begin by asking each student to introduce and tell about himself or herself. In an Instructional Technology survey course, students can do an "All About Me" HyperStudio multimedia presentation to serve as an acquaintance activity. If there is time, organize in-class games or exercises to promote the acquaintance process.

- ***Post Students' Pictures on the Web.*** Students get to know one another better if they complete a structured teacher-designed student information survey and take digital photos of each other at the first class meeting which will then be posted on a course Web page. Don't forget to get students' signed approval to post these on the Web.

- ***Schedule Personal Talks or Visits.*** Telephone talks or personal visits with students must be scheduled to eliminate a sense of isolation, keep the communication lines flowing, and foster a caring atmosphere.

- ***Assign Students to Small (Online Groups).*** It helps to decrease psychological distance if students work together in "virtual groups." They get to communicate and depend on one another as they would in face-to-face study groups.

Evaluating Student Performance

- ***Have Students Sign Honor Statements.*** Whenever students take a test online, they should be asked to sign an honor code statement that the work is their own and that they have adhered to the college or

university's academic honesty and academic conduct policies. The code they sign should stipulate they will report others whom they know are breaking the code.

- *Give Lesser Weights to Online Assessments.* Since it is always a concern about whether or not students are doing their own work, it is best to decrease the weight given to online tests and quizzes and place more weight on the individual's projects.

- *Base Test Questions on Students' Own Products.* If students must take online tests, base questions on their personally designed products or work. This helps assure the work is the student's own and makes assessment more meaningful.

- *Have Students Create a New Product.* The instructor can help provide practice and reinforcement of things learned by having students make a game, song, or puzzle, skit, cartoon strip, poem, basing on concepts they have learned. Students also can develop a lesson plan that incorporate new strategies or develop a new instructional product similar to the one they have been doing.

- *Give Practice Tests to Relieve Students' Test Anxiety.* Testing, always a source of anxiety in any course format, can be especially high when distance learning is involved. First-time online test takers needs to be acquainted with methods of online testing to avoid possible mistakes due to unfamiliarity with online software.

- *Provide Immediate Feedback*. Immediate instructor's feedback is another strategy to decrease assessment anxiety. For example, instructors should acknowledge students' work promptly after receiving it and get grades and/or feedback to them as soon as possible on performance.

- *Give Progress Reports.* There should be no surprises at the end! Students should know how they are doing at each step in the course so that they can devote more time to remediation or more concentrated efforts to their areas of weakness.

- *Provide Opportunities for Self-evaluation and Peer Evaluation.* Self-evaluation and peer evaluation are other alternative ways to allow the students to evaluate progress and recognize difficulties. Be sure to provide the criteria for the evaluation.

- *Allow Students to Give Periodic Critiques of the Course.* The students appreciate opportunities to evaluate how successful the procedures are and recommend changes to them. Their suggestions may not always be practical and worthwhile to follow, but they need to feel their perceptions are valued. Students' viewpoints often can be a valuable and helpful means of improving the course.

Motivating Students

- *Use a Variety of Strategies and Communication Formats.* Use chats, small group work, creative tasks, games, debates, panel discussions, and guest speakers to keep students from being bored and isolated. Communications should be a constant and ongoing part of each course.

- *Provide bonus points for other type of rewards for mastering difficult tasks.* Extrinsic rewards often are great motivators for learners. Provide these when students are able to complete an extra task or find the answer to a difficult question at the end of a module or unit.

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Designing a Critical Thinking Online Course

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Abstract: In this day of catchy gimmicks, 10-bit sound bites and information overload, critical thinking skills become increasingly more important for guiding both beliefs and action. The mastery of intellectual skills requires a disciplined process to ensure clarity, accuracy and relevance in the evaluation of information. A critical thinking course besides being recognized as an important general education component, endows the learner with abilities to recognize strengths and weaknesses in the presentation of information and justification of beliefs. These clear judgement skills prepare the learner to become a more thoughtful participant in increasing knowledge creation and understanding of the world. The process of designing and developing a critical thinking course to be delivered strictly online is documented and described in this paper.

Introduction

Critical thinking is necessary today for rational decision making, resolution of conflict and discovery of opposing points of view on various issues. Rational persuasion requires the recognition of common principles and agreement about the facts that are employed in winning assent and consensus. The notion of assent implies respect for the individuals' thinking abilities, thinking autonomy and equality. One seeks agreement on claims of fact and principles of reasoning, in order to begin the dialogue from a common base of acceptable evidence. The ultimate outcome of such enterprise impacts all societal structures endowing individuals with better judgements as consumers and participants in a democratic environment. Critical thinking skills provide individuals with more knowledge in terms of mastery of intellectual skills and abilities, better communication with others, autonomy of thought and discipline in thinking. These skills also enable persuasion through logical arguments rather than force or emotion. Critical thinking relies on universal intellectual criteria that is distinguished by clarity, accuracy, relevance and depth of evidence presented in support of one's point of view. Thus, critical thinking is an intellectual discipline that encompasses analysis, evaluation, synthesis and conceptualization producing better judgement and decision making. Society at large would greatly benefit from the proliferation of these valuable critical thinking skills.

Today technology provides novel opportunities for delivery and organization of education at a distance, thus reaching remote areas and enabling flexible and convenient opportunities for learners to pursue their goals. The process of designing and developing an online course requires rethinking the material presentation and interaction necessary for a successful learning experience. Of importance is the consideration of motivational structures and activities, thus ensuring student involvement and participation. Special consideration will also be given to the unique features of online instruction namely, flexibility - the

anytime, anywhere characteristics, and learner control of the pace, time use and depth of study. The issue of empowerment of the learner will be addressed through a variety of activities and projects designed to awaken and reinforce the learner's autonomy. The mode of instruction will be asynchronous which may promote deeper and more reflective thinking, a major component for critical thinking performance. Contemporary issues dealing with the Internet and computers will keep the content of the course current.

Considerations for Design

In the initial phase of this project one needs to follow a structured procedure that would ensure that the course is presented in an orderly and logical manner. First, one needs to gather all relevant materials for the course. Second one must select strategies for such a course to be pursued strictly online. Third one should plan the structure and layout of the course and the activities for interaction, motivation, participation and evaluation. Lastly one would create the necessary web pages and web materials. These considerations involve the stated clear objectives, instructional methods, media employed and activities that will make up the progression of the course. This procedure will ensure that the course is structured, yet flexible and the learning outcomes are pursued in an appropriate and relevant manner.

Gathering materials

One begins gathering the proper materials for the course by selecting the text book because any course needs a reference and supplemental material that students may use to grasp and develop their understanding of the content under study. In the present case the text chosen is *Reason and Argument* by Richard Feldman, second edition, (New Jersey: Prentice Hall 1999). This text provides the necessary documentation which will guide the development of the course. Along with the text, articles and references to other forms of argumentation including opposing views which can be found through links on the Web will also be employed. A variety of media incorporates ample examples of argumentation both propoer and fallacious, thus the students will be directed to the appropriate articles and passages.

Strategies for teaching

The lack of face-to-face interaction demands a higher level of interest, motivation and participation requirements than regular, traditional classrooms. There are other considerations that this new medium brings to the fore, such as security of trust between students and professor, security of met objectives and trust in the honesty and integrity of the participants. In contrast to traditional classrooms, one can not observe nonverbal clues that may signal difficulties and problems a student may encounter. The computer interface also challenges the issues of trust in the honesty of intellectual pursuits. In other words, instructors need to vary the evaluation procedures, for they do not witness the student answering questions or taking exams. Use of appropriate elements for achieving the desired goals need to also vary and be

flexible, allowing students to follow their own learning strategies. The teaching methodology will rely heavily on the constructivist approach which will provide an overriding umbrella for learning on the Web. As students interact with the material and the postings of the myriad of other relevant information on the web, learner control of the process will become increasingly more pronounced. The constructivist approach requires learning and knowledge structures to be built from the activity of the learner, which the instructor guides toward the achievement of desirable outcomes. The web is facilitating the introduction and proliferation of a new pedagogy, one that is more geared toward learner control and a constructivist approach to learning.[1] The fundamental principles informing constructivism focus on the learner activity which creates the environment for learning.[2] Therefore, it is crucial that the instructor adopt the role of guide and facilitator, rather than the more traditional stance of disseminator of information. Since the premise of this school of thought is that the learner achieves the objectives via knowledge construction, the instructor must attempt to design strategies which can provide synthesis of new ideas with the knowledge base the learner bring to the course. Thus, linking past and present knowledge and showing how the present concepts influence the worldview the student already has, allows for a more successful learning strategy. In other words, by showing the students the usefulness and impact the new skills can produce, one is assured of more relevant interest and motivation on the part of the student. In this course, the methods used will encompass the text book, web postings with links and discussion threads. The media employed will be an asynchronous discussion forum, web resources and private email. It is through these means that the students and the instructor will interact both with the course materials and each other.

Structure of course

The course will begin with an initial introduction to the technology employed. The first day, or the beginning of the course, in order to ease into the material and make the technology more transparent, the students will be asked to familiarize themselves with the medium. Naturally, prior to the students registering for class, a detailed description of the precise hardware/software requirements will be available along with a brief introduction to the purposes and procedures of the course. Nevertheless, in order to avoid possible surprises and misunderstandings, the syllabus will be thoroughly discussed at the outset of the course. To further increase the level of comfort and thus allow for interest and excitement about the content of the course to build, the students will be asked to introduce themselves in a brief first posting in the discussion forum. The purpose of this activity is two-fold: first, the students will be forced to participate from the start, and second, any troubleshooting will be addressed at the very beginning. Psychologically, this will also contribute to the success of the experience by alleviating possible fears and apprehensions about this form of course delivery. The content of the course itself will be divided into five modules, each

[1] Paula Doherty, *Learner Control in Asynchronous Environments*, www.aln.org/alnweb/magazine/vol2_issue2/doherty.htm

[2] B.J. Dalgarno 1996, *Constructivist Computer assisted Learning: Theory and Techniques*, Available: http:// farrer.riv.csu.edu.au/~dalgarno/publications.html [1998, June 12]

with a segment of material and a graded assignment at the end. To ensure integrity and honesty these grades will only constitute a portion of the final grade for the course and the students will be asked to discuss their assignments thoroughly. The very last assignment for the course will be a short argumentative paper, which will incorporate the principles of argumentation discussed throughout the course. In the discussion forum, the students will be required to contribute a minimum of three posting a week, to ensure at least minimal participation, although it is hoped that participation will be much more frequent than this. To allow for greater flexibility, the students will have the opportunity to influence the direction of the course, again within the more structured objectives. This will be realized in the hope to further break down the use of technology as well as the more traditional distinction between instructor and student roles.[3]

Activities

The core of the activities for this course will be comprised of discussions and arguments that will be posted within the area of the discussion forum. The students will be assigned reading from the text, along with suggestions and links to major newspapers, journals and magazines. The publications will first be scoured by the instructor for relevancy, and then the students will be asked to identify and thoroughly discuss the arguments found within. Since the scope of the course is to develop the skills for persuasion and clear thinking the passages selected will be investigated and analyzed in light of the claims, principles and backing facts the authors employed to present their viewpoints. These ideas will be further evaluated to discover the underlying truths. Thus, the majority of interaction for this course will take place in the asynchronous discussion mode, where arguments and debates will be encouraged.

Course content and learning strategies

The activities planned for this course will involve in the first module studying and evaluating arguments. This module will include tips for discovering indicators for premises and conclusions and distinctions between other forms of dialogue such as explanations, descriptions and other passages. The importance for an argument to make a claim and support it with grounds and facts will be stressed. In order for the students to become familiar with these concepts, various examples from articles, political debates and other sources will be shown. After the study of arguments will be completed, a discussion of truth will follow. The reasons for truth, why one should bother with it and how one could determine truth and veracity comprise the second module of the course. Evaluation of sources, especially those one finds on the Internet will constitute part of this module, as it becomes increasingly more important for principles and techniques to be known and employed in the evaluation of information. Ours is an age of information

[3] Robin Mason, *Models of Online courses*, http://www.aln.org/alnweb/magazine/vol2_issue2/Masonfinal.htm [October 1998]

explosion, and thus individuals need perfected skills for making judgements and decisions. This unit will also show the relevancy of the study of critical thinking in our daily lives. The third module will deal with argument structure: the principles and rules employed in creating and evaluating arguments. This portion is of major importance for it shows how the arguments themselves are constructed. During this module examples of rules such as Modus Ponens and Hypothetical Syllogism will be explained and discussed. Students will be asked to find or create examples and describe the application of these rules. The fourth module will address mistakes in reasoning, in particular fallacies. Such mistakes are very common, from commercials to editorials and opinionated papers. Students will learn how to discover fallacious reasoning, which unfortunately can be encountered often in everyday life. The skills of determining fallacies will improve learner ability to become a more rational and knowledgeable participant in society. At the same time, these skills will prepare individuals to become better consumers and voters. These four modules will culminate in the last portion of the class in which students will be asked to write a short argumentative paper on a controversial issue of their choice. The paper is intended to allow students to synthesize the various units of the course and thus apply their new knowledge. During preparation for this paper a review of the modules will be provided as an aid and reinforcement of the new skills. At the same time, examples of contemporary issues will be employed, analyzed and examined. At the end of the fifth module, which will also correspond with the end of the course, the students will be asked to submit the paper for evaluation and grading.

To ensure that the course provides the highest quality of interaction, a continuous evaluation of the course and self-evaluation by the students will be used at the end of each week of the course. This evaluation will be in the form of a questionnaire similar to the ideas presented by Stephen Brookfield in a speech delivered at National-Louis University[4]. In this speech, Dr. Brookfield shared some of his strategies for teaching and learning. He stressed the importance of self-evaluation as an added instrument in assessment. He also discussed his method of using anonymous questionnaires to monitor weekly progress and resolve problems. The questionnaire employed in this course will be an adaptation of the one Dr. Brookfield described. For this course the questions will include weekly updates about the strategies and activities performed during the week. Were these activities promoting better understanding of the material, are there other activities that would enhance the learning process more and which would be desirable to include in the course, were there negative outcomes in the discussion of course elements and suggestions for improvement. It is hoped that continuous monitoring and timely resolution of conflict will enhance the course and ensure its continual success. All the materials for this course will be written in Microsoft Word and saved as HTML for easy upload on the web pages. The discussion portion of the class will employ the software package DiscusPro Forum. The course will be delivered during the winter quarter (beginning of February and the end of March 1999) through the Division of Continuing Education and Outreach at National-Louis University.

[4] Stephen Brookfield, Keynote Speech delivered at the Winter Faculty Retreat of National-Louis University, December 9, 1998.

WEB-BASED EDUCATION: HOW TO ASSESS STUDENTS PERFORMANCE?

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Abstract: The assessment of students performance is not a easy task. The diffusion of Web-based education is bringing new challenges in the area. In this paper, we briefly discuss how to assess students performance in virtual classrooms.

1. Introduction

In the nineties, changes in education focus can be pointed as a remarkable fact. The challenge, today, is to design computational environment to support the knowledge construction, instead of continuing to develop software based on contents memorization and repeatness. The breaking up with overshot issues has brought out important impacts on educational software. On the other hand, Web-based education is here to stay and its acceptance among educational community is becoming unprecedented. Therefore, virtual education faces us with deep challenges. The most visible one is certainly related to how to promote students learning, under a Constructivist viewpoint, and as result, how to assess students learning.

In this sense, this paper purpose is to start a discussion concerning students performance facing the growing up of the educational Web.

2. Assessing Students Performance

The primary purpose of assessment is to improve student learning. We must provide useful information about whether students have reached important learning goals and about the progress of each student We must also employ practices and methods that are consistent with learning goals, curriculum, instruction, and current knowledge of how students learn. Good educators assess student learning through such methods as structured and informal observations and interviews, projects and tasks, tests, experiments, portfolios, and journals. It is not an easy task, even when we use the face-to-face approach. Then, how to do that if students are located remotely?

The diffusion of the Web constrains us to find different ways of assessing students learning. Web-based education benefits seem to be unlimited. The Web can enhance teaching and learning by giving students' access to a powerful set of information tools. By using Internet connectivity, the students also may be exposed to video-conferencing technologies. Multimedia examples used to illustrate specific topics can then be accessed by the student at home from the course's Web site and followed up with an interactive course assignment. Links to supplemental material can be used to provide more depth to many topics.

In addition to developing virtual classrooms, the creation of Web-based courses may encourage the development of integrated courses where teachers from different disciplines come together to teach a single course.

Using the power of the Web interface for both the creation and delivery of course material has a number of advantages for the student, including:

- delivery of course material independent of time and geography,

- the ability to serve a large number of students at virtually no marginal extra cost;
- course material can consist of lecture notes, multiple-choice question forms with automatic grades returned to the student, timed quizzes;
- supplemental reading; assignments;
- glossaries;
- multimedia (audio and video);
- e-mail;
- course marks and student self-evaluation forms.

3. Web-based Education: How to Assess Students Performance

We usually evaluate students via conventional assessment apparatus, such as tests, homework, and so on. We do not use to evaluate their learning process. Face the growing up of virtual courses, we must also consider other assessment dimensions, such as:

- which paths did the students run through course materials given by the teacher?
- these paths did allow them to reach the educational goals?
- which supplementary sources did they consult?
- did they research and utilize supplementary sources given by the teacher?
- did they research and utilize supplementary sources found by their self?
- what was their contribution, and in which degree, in cooperative tasks?
- how frequently did they contact the teacher by e-mail?
- did they contact the teacher only face examinations proximity?
- how was their assiduity and participation in chat, video-conferencing, mailing lists and newsgroups?
- did their works show a good utilization of the educational resources, available in the courses?

Unfortunately, we do not know how to integrate these dimensions in students' assessment. In face-to-face approach, we diffusely consider them in the global evaluation. Besides the traditional assessment apparatus, we are proposing the use of available Internet software, such as AccessWatch, and a qualitative analysis of students' performance.

AccessWatch [http://www.accesswatch.com] is a World Wide Web utility that provides a comprehensive view of daily accesses for individual users. It provides a regularly updated summary of WWW server hits and accesses, and gives a graphical representation of available statistics. It generates statistics for hourly server load, page demand, accesses by domain, and accesses by host. AccessWatch displays results in a graphical, compact format.

Using an Internet software, such as AccessWatch, we can analyze students' history of navigation. The history of navigation can mirror students browsing, helping us to answer question such as:

- which paths did the students run through course materials given by the teacher?
- these paths did allow them to reach the educational goals?
- which supplementary sources did they consult?
- did they research and utilize supplementary sources given by the teacher?

Moreover, how to evaluate students participation in cooperative tasks? We must regard students' interactions with available cooperative tools (chat, newsgroups, mailing list) and try to quantify their participation. Besides to quantify it, we must analyze the qualitative level of individual participation.

Finally, we must compare these findings with the students' performance in tests, homework and tasks. It is important to see how the Internet functionalities and cooperative tools are stressing students' performance.

The assessment of students' performance is one of the most important issue related to Web-based courses. Consequently, we can be hopeful that in a very near future corresponding guidelines, prescriptions and methods will be proposed.

Usage of Educational Web Pages to Develop Students' Higher Order Thinking Skills

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Abstract: The aim of the present work was to study applicability of the relevant teaching method based on supplementary printed students' worksheets together with two educational Web sites - "Estonian Vertebrates" and "Estonian Plants". The teaching method was fully approved by the expert group of 27 pilot teachers. In case study we were concerned with enhancing students' abilities to analyze and synthesize connected with educational tasks on worksheets. The results of the study clearly demonstrated the applicability of educational Web pages together with appropriate teaching method to develop students' higher order thinking skills. Furthermore, we tried to estimate the impact of computerized biology lessons on students' motivation and their attitudes to the problems of environment protection and Estonian nature. Students' answers in the questionnaire suggested that this approach was justified.

Introduction

Estonia is currently undertaking reforms in its educational system. The implementation of the new State Curriculum in Estonian schools began in autumn 1997. The reform is taking into account Estonian aim to integrate into European Union structures. The current reform covers pre-school education in kindergartens, general basic schools, upper-secondary general schools and vocational education. Following from the new curriculum, different subjects are integrated by common themes by considering relationships between humans, nature, technology and society. "Informatics and infotechnology" is one of this (Estonian State Curriculum, 1996). The learning process and teaching methods are diversified by infotechnology. It supports systematic thinking, technological skills and enables students to have their own individual style of learning.

At the present time about 200 out of 350 Estonian secondary schools have their own computer classes with the direct or dial-up Internet connection. However, our previous investigations revealed that Estonian teachers did not use computers in science lessons (Sarapuu, 1997). The situation can be explained with the absence of educational software, in particular, in Estonian, but also with teachers' lack of knowledge and skills in application of appropriate teaching methods.

In most countries it is comparatively easy to find software to teach various subjects. But in Estonian schools, where English is the second language, educational software, except in Estonian is not applicable in learning process. Some software could be translated from other languages, as there are a lot of common problems and themes in curricula of all the countries. However, in case of natural sciences, especially in biology, each country must create its own. It is caused by the well-known fact that the nature of each country is unique, all the species of plants and animals exist in distinctive conditions with their own specific relations. Knowledge about local nature, its diversity and environmental problems can be acquired on basis of local examples and facts. One of the simplest ways to create educational software embracing the possibilities of multimedia is to

compose instructional Web pages. Therefore our Department initiated the development of two educational Web sites - "Estonian Vertebrates" and "Estonian Plants".

Educational Web Sites

The Web site "Estonian Vertebrates" (*http://sunsite.ee/loomad/*) includes information about five groups of vertebrates - fishes, amphibians, reptiles, birds and mammals. (Some parts of this site are also translated into English - http://sunsite.ee/animals/) The database concerning about 300 species of the most common Estonian vertebrates forms the main part of the site (Fig. 1.). Information about each species has been presented on two Web pages considering students' different abilities and age. The first page contains the description of particular species, its appearance, distribution, abundance, feeding, reproduction, development and endangerment. The topics are illustrated with color photos and voices. It has fewer terms and simpler vocabulary in order to be applicable in basic school biology classes. The information on the second page of each species is filled in a table including some more scientific facts. This page is supposed to be used mainly by secondary school students. Common layout, usage of hypertext, search engine and the site map facilitate application and finding information.

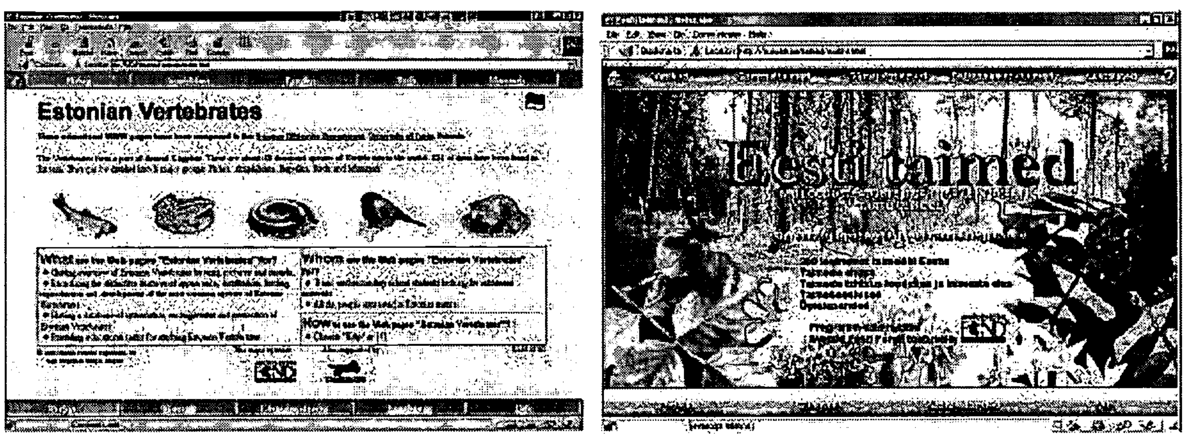

Fig. 1: The front pages of "Estonian Vertebrates" (*http://sunsite.ee/animals/*) (on the left) and "Estonian Plants" Web site (*http://sunsite.ee/taimed/*) (on the right).

The second educational site - "Estonian Plants" (*http://sunsite.ee/taimed/*) - follows the same principles of design as "Estonian Vertebrates" (Fig. 1.). The main part of the site consists of descriptions of the most widespread species of Estonian plants (ca 340) together with illustrative photos. There are general information, taxonomic specifications and local aspects about five groups of plants - Algae, Bryophytes (mosses), Pteridophytes (ferns), Gymnosperms and Angiosperms (flowering plants). One can choose the pages of herbs, plants under protection, poisonous and edible plants. Several figures illustrate morphology and structure of different groups of plants. Symptoms of becoming poisoned and methods of first aid are touched upon in case of poisonous plants. The pages of herbs explain what parts of them to use, where they grow and what diseases can be cured. As far as edible plants are concerned, there is exact information of what parts could be eaten, when and where they could be picked and used.

The skills and requests of the broad range of users have been taken into consideration in designing Web pages "Estonian Vertebrates" and "Estonian Plants". Both educational Web sites provide students with opportunities of writing reports, essays, research work and different types of projects in extra-curriculum activities. University students and all the people who are interested in studying Estonian nature can also benefit from the materials.

Educational Web sites "Estonian Vertebrates" and "Estonian Plants" are suggested to teach various themes in integrated science, biology and environmental study according to the new Estonian State Curriculum. There are opportunities to check one's knowledge and the results of tasks in the software. Computerized educational tasks composed on the basis of "Estonian Vertebrates" and "Estonian Plants" enable students to learn the particular themes independently, to acquire scientific facts, but also to develop their memory, comprehend, apply

the facts and check their knowledge. More attention was paid to systematic learning than to memorizing facts. Various electronic tests added to the package provide teachers with necessary feedback of students' knowledge and abilities.

Teaching Method and Supplementary Materials

It is impossible to create the computerized tasks satisfying all the teachers' aims and to adapt them to each theme in curriculum. Therefore, we have also compiled supplementary printed worksheets for students. Worksheets can be used without any changes or might serve as examples for teachers to work out theirs own ones.

According to the teaching method developed in our department (Adojaan & Sarapuu, 1997), at the beginning of a 45-minute lesson the first ten minutes have to be spent on becoming acquainted with the program. It is essential for both beginners and advanced users of computers, as the pupils can get a survey of the structure of the pages and to satisfy their curiosity. A special introductory printed worksheet for students has been compiled for both "Estonian Vertebrates" and "Estonian Plants". It introduces the aim, scope, structure and the ways of application of certain Web site.

Next, after the introductory part of the lesson students get separate printed worksheets with various educational tasks. Students have to work independently solving the tasks for 35 minutes. Each worksheet consists of 3-4 units related to each other (Fig. 2.).

Our previous studies suggest that computers are not effective tools for only acquiring knowledge, comprehending and memorizing facts (Arro & Sarapuu, 1996). Therefore, it is essential to compile the worksheets not only for finding and memorizing facts, but also for developing students' higher order thinking skills. Every unit begins with a question or description of task, next, students have to find required information on different Web pages and fill it in the table or blanks. After that they have to analyze, synthesize and evaluate the found information according to next question or task. Solving the task is connected with all the categories of cognitive domain: knowledge, comprehension, application, analysis, synthesis and evaluation (Bloom et al., 1956).

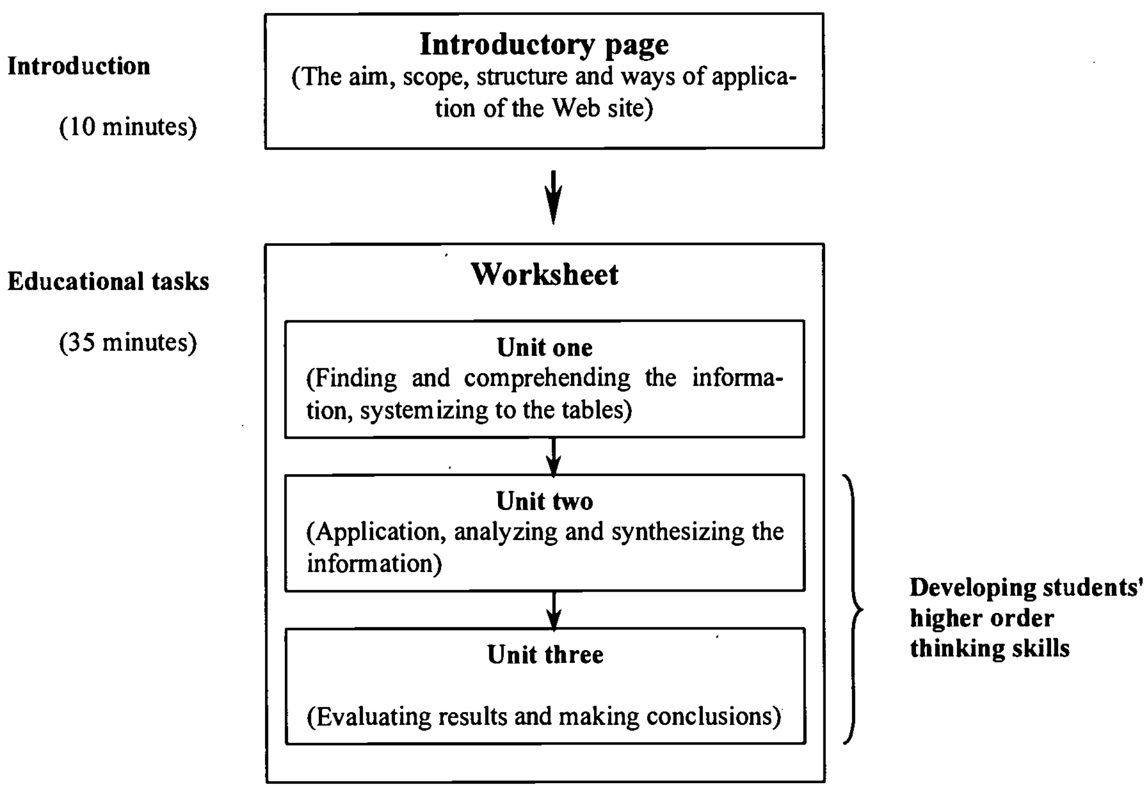

Fig. 2: Teaching method based on supplementary printed students' worksheets together with educational Web sites.

An Expert Group of Biology Teachers

27 biology teachers form an expert group. They had previously passed an advanced in-service course in usage of computers in school biology. An introductory lecture about the objectives and contents of appropriate teaching methods was conducted. Next the teachers participated in hands-on workshop. They used both "Estonian Vertebrates" and "Estonian Plants" together with supplementary printed student worksheets. Soon after the workshop the teachers were asked to fill in a questionnaire about the teaching method and the contents of student worksheets.

Some weeks later teachers conducted computerized science lessons in theirs own schools. They composed also new worksheets and students had to solve the educational tasks based on the materials either "Estonian Vertebrates" or "Estonian Plants" Web site. Subsequently teachers evaluated both educational Web sites and the teaching method (Sarapuu et al, 1998; Sarapuu & Adojaan, 1998).

Case Study

The main goal of the present case study was to try out the teaching method described above. Three teachers used "Estonian Vertebrates" and conducted 9 pilot lessons in computerized biology classes of different schools. 27 basic school students (age of 14-15) and 59 of them (age of 16-17) in secondary school solved educational tasks on two different types of worksheets. A group of 10-15 students solved one task during one 45-minute lesson. A control group of 10 basic school students worked independently with "Estonian Plant" and solved the educational tasks on worksheets.

Immediately after the lesson students had to fill in the questionnaire. They were asked to evaluate the Web site together with the worksheets and to express their opinion of possible application of the Web site in biology lessons and its relevance to everyday life. In addition, some questions were connected with students' previous experiences and their relations to computers.

We examined also students' supplementary worksheets and analyzed their answers. Different units solved by students were used to make conclusions about the finding information, comprehension the contents of topics, but also about their abilities to analyze, synthesize or evaluate (Fig. 2.).

Results and Discussion

The most important prerequisite in usage of educational Web sites is finding and comprehension of information. Pilot lessons indicated that both basic and secondary school students could successfully apply the "Estonian Vertebrates" and "Estonian Plants" as a source of information. The conclusion was based on filled worksheets and students' opinions revealed in questionnaires. All 59 secondary school students and 37 from basic school found the necessary information on Web pages. Only 2 % of basic school students had a few problems. Almost all the students who worked with "Estonian Vertebrates" or "Estonian Plants" gave positive response to the question - "Was the program convenient to use in solving the tasks?" 92 % of students answered that it was easy to find the information or they had only few problems. Approximately 8 % of students confessed to have found the information with much trouble. Only one student from 10 who examined "Estonian Plants" declared to have had much trouble in finding information. The comprehension of the texts did not cause any difficulties to students, as they did not ask the teacher to explain them terms or the contents of certain topics. Consequently we suggested that there were not any considerable obstacles for the application of "Estonian Vertebrates" or "Estonian Plants".

Some difficulties in pilot lessons were caused by students' lack of experiences in using computers. Approximately one third of the students had not had beginners' course in computing and obviously they had not had any other possibility to use a computer. However, Estonian students are interested and willing to use computers in learning any subjects. There was a question - "How big is your interest in computers?" - in the questionnaire. 68 % of students wrote that "computers are of some interest" and 19 % of them claimed that "they spend every free minute on computers". Merely 5 % of students gave a negative response to the question - "Did you like the lesson today?" 78 % chose one of the positive responses ("I liked it very much" or "I liked it") and 17 % of students was indifferent towards the lesson.

Students had to solve different educational tasks on two types of worksheets in computerized biology lessons where "Estonian Vertebrates" Web site was applied. Students' answers to the questions provided us with the material, on the basis of which we could draw conclusions about their abilities to analyze, synthesize and evaluate. One can examine this on the basis of worksheet titled as "The development of birds after hatching." The objective of this lesson was to study differences in birds' development in the period after hatching. The worksheet consisted of the following three units:

1. Students had to find Web pages with six particular species of birds and look for the information about their nesting, hatching and development of the young. Next, students had to find the common features of young and divide these species into two groups. The answer had to be presented in the form of table.

This unit of the worksheet enabled us to make conclusions about students' abilities to find the appropriate information, to comprehend and analyze it. The results of solving this task suggested that the ability to analyze of the students who participated in pilot lessons was rather poor. There was a considerable difference between the basic and secondary school students - only 31% of basic school students and 79% of secondary students did well in this part.

2. Next, students analyzed the contents of the table and made conclusions about the development of two types of young - precocial and altricial.

The second unit gave us information about students' abilities to analyze and synthesize. The analysis of worksheets gave us information about students' abilities: 49% of secondary school students did it well whereas only 15% of basic school students could make a correct generalization.

3. Finally students had to evaluate possible reasons for different types of development.

This unit enabled us to draw conclusions about students' abilities to evaluate. Only 8% of basic school students did it correctly and 85% of them did not do it at all. The results were comparatively better among the secondary school students – 33% did well and 49% could not find possible reasons. Thus the students who took part in pilot lessons showed the worst results in evaluating.

Conclusions

According to the principle that everyone should be able to read natural scientific and technological texts there is information concerning daily life and themes of general interest both in "Estonian Vertebrates" and "Estonian Plants". Students' answers in the questionnaire suggested that this approach was justified. For example, 46 % of students who worked with "Estonian Vertebrates" said that they had got to know something useful for everyday life. The themes of Estonian nature and environment protection are central themes in the new Estonian State Curriculum. This area of study brings teaching natural sciences closer to everyday life and society. Another aim of both educational Web sites is to motivate students to become more interested in these areas. 35 % of students answered that the lesson with "Estonian Vertebrates" made them be more interested in Estonian nature and the problems of environment protection. 25 % of students claimed that it made them be more interested in school biology.

Students' answers allowed us to conclude that their abilities to analyze, synthesize and evaluate were rather poor. The results reflected better ability to analyze and synthesize by secondary school students compared with basic school students. The difference did not significantly depend on whether "Estonian Vertebrates" or "Estonian Plants" was used. Consequently we suggest that solving similar tasks enhance students abilities to analyze and synthesize.

A group of experts approved the proposed teaching method and considered it to be applicable both in basic and secondary school. They only mentioned that provided educational tasks for "Estonian Vertebrates" were more interesting and applicable in basic school (Sarapuu & Adojaan, 1998).

Finally we can conclude that "Estonian Vertebrates" and "Estonian Plants" together with supplementary materials and appropriate teaching method can be effectively applied in developing students' higher order thinking skills and enhancing learning motivation. The proposed teaching method is not only applicable with "Estonian Vertebrates" and "Estonian Plants" but with any educational Web site consisting of appropriate information.

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An Experiment in Teaching ESL Via Distance Education Online

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Abstract: The purpose of this study was to design, develop and pilot test a simple hypertext (web-based) university level Education course as a format for distance education.

Introduction

The School of Education at Oral Roberts University (ORU) in Tulsa, Oklahoma currently administers a diverse but cohesive teacher education program which includes graduate programs in Christian School Education, Public School Administration, Teaching English as a Second Language and Early Childhood Education. In recent years ORU's Summer Institute and School of Life Long Learning have assisted the College of Education in extending their programs to meet the needs of teachers and administrators who work during the academic year within K-12 settings by offering graduate degrees in a format which may completed through a combination of traditional correspondence and Summer Institute study. ORU's Summer Institute holds intensive summer school sessions each year during which graduate students complete 50% of their course work in 2 to 6 week sessions over the course of 2 to 3 summers. Although the joint program offered by the Summer Institute and the School of Life Long Learning has been successful, many students have indicated that they would like to be able to complete all of the required core courses for a given degree program via a distance education format instead of attending as many Summer Institute sessions.

Ann Shortridge, an ORU Alumni and a doctoral student from the University of Houston's College of Education approached ORU's College of Education in regards to pursuing instructional web development projects and was referred to Dr. Hallet Hullinger, Assistant Professor of TESL. Shortridge, Hullinger, and Joshua T. Fisher, Director of Correspondence Studies for ORU's School of Life Long Education participated in initial discussions to determine whether or not a web-based learning environment was feasible in regards to further extending ORU's College of Education Correspondence, Summer Institute programs. Retrospectively, Dr. Kip Tellez, Assistant Professor of ESL at the University of Houston agreed to participate as an additional expert content stakeholder.

In an effort to align the goals of all interested stakeholders, preliminary discussions between Shortridge, Hullinger and Fisher addressed ORU's future goals, plans and directions regarding distance education. Concern was expressed by Dr. Hullinger that web based distance education might be negatively perceived by College of Education faculty or those in other departments. Further, it was also postulated that a simple web-based learning environment project might conflict or compete with university goals or plans already set in motion. Currently, ORU is actively considering developing multi-media CD-ROM course materials with web based support for all of their undergraduate general education curriculum which is now offered through distance education.

After a thorough discussion all three parties agreed that the best approach would be to choose a course (or group of courses) which lay outside of ORU's general education curriculum for a research pilot. Cross Cultural Communication was chosen as it is a course which is taken by a variety of students across disciplines, including Education. Further, Cross Cultural Communication is a required core course for most degrees within the College of Education.

Design of the Initial Course Pilot

ELE 413 and TESL 513 represent the undergraduate and graduate sections of Cross Cultural Communication. This course offers an overview of the field of cross-cultural communication, including theories and models, major concepts, terminology, and current research. In addition to the theoretical base, emphasis is placed on effective teaching in the multi-cultural classroom. The web site was specifically designed to meet the needs of students with lower end computing systems via a Rapid Prototyping Instructional Design Model. Thus, the web site employs primarily a text format with a rich web resource section. Further, special emphasis was placed on 1) visual consistency, i.e. all pages of the site were developed with a common user interface, and 2) navigation.

Macintosh Cybertech Resources Pages (1997, Macintosh Human Interface Guidelines [Online], Available http://www.cybertech.apple.com/HI/hi_resources/hi_princ/intro.html [July 15, 1997]) lists 13 points of concern in regard to good human computer interface design: metaphors, direct manipulation, see and point, consistency, WYSIWIG, user control, feedback and dialog, forgiveness, perceived stability, aesthetic integrity, modelessness, knowledge of the audience and accessibility. As not all of these factors apply to less interactive environments, TESL 513/ELE 413 web pages were designed by addressing the following issues: visual range and overall composition within a specific window size, consistency and aesthetic integrity.

In the realm of interface design, the term metaphors refers to the use of visual images as they tie the viewer/user to a previously understood meaning. For example, most individuals around the world recognize the Statue of Liberty to be symbolic of the United States, or the Eiffel Tower to be symbolic of France. A metaphor simply brings to mind an association. Another good example of the use of metaphors is the use of icons on a computer screen to suggest certain actions available to the user, such as a trash can to dispose of electronic files. The question of composition must be addressed any time various materials (type, line art, photographs, etc.) are combined to create a collage. The use of such symbols in essence provide the composer a medium for communication; even if that communication remains only visual as in the case of a drawing or a painting. Good composition emphasizes some elements while downplaying others. Further, good composition takes color, movement, space and light into consideration.

In the field of visual representation, particularly printed or web based material, the designer must strive to maintain a consistent face for the reader, user/viewer. Consistency allows the user to relax because it demands the creation of a simplified environment/product. When each page maintains a face which is similar to the first the viewer can concentrate more easily on the text or content. Further, this consistency provides for a visual coherence. One example would be to consider what attitudes might develop towards a newspaper that looked different every day that it hit the streets, before too long most readers would doubt the authority of the newspaper in question. Another example would be to consider a busy web page. If a web page with too many different colors and too much animation where no supporting pages look or feel like the homepage, a viewer would quickly wonder if he/she had stumbled by accident onto another web site.

In addition, web site was laid out following some basic ideas outlined by Information Processing and Cognitive learning theorists. The content and supplemental/support material for the course was broken down into parts which act as a cognitive map for participating students. Another key feature of the web site is a threaded discussion group or Hypergroup. (The HyperGroup interface is an experimental, web-based, hypertextual interface to automated E-mail distribution lists (listservs) housed on College of Education information server at the University of Houston.) This web site contains four major sections: Visitors, The Virtual Classroom, Resources and The Listserv (Hypergroup). To view the web site please go to: http//:www.coe.uh.edu/~shortam/tesl513.html

Alpha Test

The web site was launched during ORU's 1998 Summer School; Session I, beginning May 26th 1998. In essence, Dr. Hullinger (the instructor for Cross Cultural Communication) planned on using the web site to support instruction during the first half of the 1998 Summer Session and as a distance education medium for the second half. The Hypergroup served as a forum for general discussion during the classroom/support section of the pilot and as a discussion group and a mode to turn in specific homework assignments during the distance education section of the pilot. Ann Shortridge was introduced by Dr. Hullinger and conversed in the on-line

class discussions. Technical advice was minimal, i.e.; the students appeared to be able to navigate and perform all of the course related tasks.

Alpha Test Feedback

During the last few days of the 1998 summer pilot Ann Shortridge emailed a survey to all of the participating students. Unfortunately, only three students were enrolled and only two of those three responded to the survey questions, thus, no statistical analysis was conducted. An N of less the 30 is not statistically significant.

The questions posed in the survey were taken from a survey supplied by Dr. Bernard Robin, Assistant Professor of Instructional Technology at the University of Houston. Questions that did not apply to this pilot course were deleted and several pertaining specifically to distance education were added. Future semesters with larger enrollment numbers are expected to produce more adequate statistical results.

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On-line Distributive Education Project

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Abstract: This paper is a report on an ongoing project to implement and evaluate prototype on-line delivery systems for graduate and undergraduate courses. In the hands of instructors who are good teachers, with course designs that are effective and adapted to course material and learners, and with adequate network support, on-line courses can be successful and effective. To accomplish this an inter-disciplinary team is assembled to design, test, and implement a prototype for on-line teaching. The primary outcomes of this project are the identification and development of instructional technologies, approaches to design and evaluation of online courses, and the professional development of Faculty. This paper describes and identifies problems encountered in this process and solutions used to remedy these.

Description

The distributive on-line project is an initiative of the Faculty of Education at the University of Lethbridge in Alberta, Canada. This project investigates the effectiveness and feasibility of making components of courses or entire courses available to our students from a distance. This is a report of a work in progress. This paper describes initial experimental stages, development of prototypes, list problems encountered, processes used, speculates on the implications for learning, and discusses future directions.

The term "distributive" suggests that learning is not just the delivery of information but that information becomes transformed to knowledge and understanding. This process involves more than passive involvement so part of the mandate of this project is to explore diverse instructional strategies that engage the learners with the course materials, with other participants, and the instructor.

Purpose

The intent of this project is to assist Faculty members developing and implementing on-line versions of their courses, or parts of their courses. To accomplish this an inter-disciplinary team was established to design, test, and implement a prototype for on-line teaching in the spring of 1998. It is not the intent to create a template that all courses will fit into. Rather, this project's goal is to develop a set of generic tools that can be selected and adapted by instructors. It is not anticipated that all courses will use all the tools, nor will the tools necessary be used in the same way. The project provides tools and the expertise to appropriately infuse the technology into existing courses.

Rationale

Why be involved in an on-line project? The answer to this question is multifaceted. A central point is that communication technology is viewed as a tool, and it is the appropriate use of this tool that is compelling. The tool can facilitate new ways of thinking about teaching and learning. These new ways of thinking come from matching teaching/learning strategies with features of the tool. The research and development of on-line courses provides a platform for investigating this relationship. Another reason for our interest in this area is the

pragmatic issue of access to programs. The Faculty offers its four core courses in the M.Ed. Program to cohort groups in distant locations. Instructors travel to these locations to teach courses on weekends. If some of these courses could be delivered in part or in whole by the Internet, the cost in dollars and time of Faculty members would be reduced. In addition, students in these cohort groups do not presently have an opportunity to take elective courses during the regular semesters once they have completed the four core courses. For this reason they seek independent study courses. If electives were available on-line, it would meet the needs of these cohort groups. In addition, opportunities exist at the undergraduate level. It is not necessary to think of online courses being an all or nothing situation, these resources can be used to supplement traditional face to face courses with enrichment, review, as well as alternative forms of resources, interaction, and collaboration.

Moving on-line generates a number of stresses and strains on the project and the institution. These strains come from concerns about the financial viability developing on-line courses and questions regarding the educational value of such an initiative. Also there are those who want to get involved but don't have the expertise or knowledge to make it happen adding to the issues that the project is addressing. Before initiating an on-line course the rationale for such a move and a planned strategy for its success needs to be considered and articulated.

Putting materials on-line can benefit the traditional class because it can provide students:

- timely information
- a platform for on-going discussion and thoughtful reflections outside the regular classroom
- important information that is available any time and can be updated and distributed easily
- resources that can be subdivided and made available at opportune times and linked to related content
- timely feedback to assignments and questions can increase student effectiveness

These advantages are available to both on-campus and distant students. Another purpose of this project is to support courses that will be done entirely on-line. In this case it saves students the time, expense, and dangers of commuting to a distant locations and being available at a designated times.

This project is set up to support mixed courses that lend themselves to partial on-line support and partial face to face contact. In other words we want to support and guide Faculty to use technology appropriately given the situation.

Process

In the summer of 98 the project team began by working on a generic structure for the on-line course outline as well as the look and feel for some on-campus workshops. This was a useful exercise because it gave the team an opportunity to pilot ideas with students who were on-campus who we could watch. After this initial experimentation, the team determined the look and feel of the web pages and that the course schedule should drive navigation through the web pages. An on-line reflections database was developed and tested. These on-line on-line reflections represented students comments about the content of the course as well as opinions on the on-line materials.

In the Fall of 98 there was a more ambitious pilot done with a graduate course that was offered at a distance. In this case there were face to face sessions as well as on-line components. A number of tools were piloted at this point, on-line reflections, pdf files, newsgroup, on-line gradebook, and on-line submission of assignments. In addition, a CD was developed for this course that would allow students to access linked resources without the need for lengthy download times. It was setup so that students would seamlessly go from information on the CD to the on-line tools. Web pages coming off the CD were so indicated with a watermark so it was evident to the user when they were on-line or when they were using the CD. Some technical problems were encountered because of the variety of configurations in the field. For the Spring 99 semester this problem has been reworked with a front-end that helps students through the process of installing the necessary components on their systems. There were other problems as well, including students having difficulty logging onto their on-line gradebook because the University uses a different user name than what they use on their own system. Some of these problems and difficulties are easily resolved with clear instructions. The important point here is that technical and procedural glitches are bound to crop up, which makes the process of prototyping and constant revamping of materials is an essential aspect to developing on-line courses. In other words, expect setbacks and problems.

Team

This also brings up the issue of the development team. An inter-disciplinary team was established to design, test, and implement a prototype for on-line teaching. Each week we met as a team to discuss progress, set time lines, resolve problems, develop policies, and determine procedures. In this way emerging problems or difficulties are aired and resolved by consensus of the group. During this time ideas are presented, critiqued, and alternatives brainstormed. This process is an important aspect to the evolution of the on-line materials. The team is comprised of the head of the project, a coinvestigator, a research assistant, a development manager, two multimedia personnel, and the manager of technology for the Faculty. On occasion, our numbers are increased by representatives from the University as a whole and Faculty members interested in putting their courses on-line. For other institutions exploring the notion of on-line courses, this team approach is highly recommended.

The mandate of the project is to develop a course that would be offered totally on-line in the Spring of 99. In the Fall of 98 work began on this course. Much of the development of the tools and their fine-tuning had already been done for the Fall pilot offerings. The background work for these pilot offerings greatly facilitated the production of an entire on-line course in the spring. It is therefore prudent to work into on-line production in a graduated way. Using pilot courses, which involve limited on-line components, allows testing and fine-tuning of the products and process without the all out risk involved with an entirely on-line offering.

Products

It is hoped that the outcomes of this project will be adaptable to other course content and domains. One of the products is a set of procedures that set out the lowest common denominator in terms of software, hardware, and skill level that the project will support. Several databases were devised to survey prospective students in this regard. This information helps the team diagnose and work through individual problems that arise given knowledge of their level of expertise and their technology platform.

One of the expectations of this project is that it be a platform for other Faculty to become involved. In order to have participation to take place in an orderly fashion, the team developed a time-line for Faculty involvement. This information alerts Faculty of the development time required. In this way Faculty can give the nature of their courses, activities, and assignments due consideration before putting them on-line. Merely translating courses into web pages does not make sense and may not result in appropriate use of technology. The time line affords the team, time to meet with interested Faculty and begin the process of matching the communication technology tools with features of the courses. The thinking is that the solutions that are offered provide some educational advantage.

Another important role of the project is to investigate the value of on-line offerings as well as to determine their economic viability. With the offering of a totally on-line course in the spring semester, the project plans is investigating these issues with a variety of research methodologies as listed below:

case studies
questionnaires
student comments/communications
assignments
peer evaluation
monitoring on-line access

Some of these methodologies have been tested with students in our pilot courses in attempts to fine-tune those tools. Here are some sample comments made by students through on-line reflections:

"I have finally worked out the difficulties that I had. I believe that the problems were founded in my own computer and not the website or CD. The CD is very user friendly and interesting."

"I will not be able to attend the session on Oct. 24th. Hopefully anything needed from that session will be available online."

"I'm getting real comfortable with the methods of using this online interactive stuff for assignment purposes. I think its just great."

"Still having problems with Netscape freezing sometimes when I go online from the CD. I just tried to submit and it wasn't accepted by U.Leth. I dislike wasting time over this type of problem."

"I found this week that the website was hard to get onto, so it was nice to have the CD as a back up."

"I found it very easy to use and manage. Some of the files, I think its the shockwave ones, take a long time to load, but that could just be my computer."

As previously mentioned, an important aspect to the development of an on-line project is the establishment of a development team. The challenge for the team is to develop generic tools that could be used in the pilot courses and future courses with some modifications. The team has come up with a number of interactive on-line tools, which were identified and tested:

- peer evaluation for allowing students to evaluate each others work
- reflections; for submitting comments about the content of the course and the on-line materials.
- newsgroup; for class discussions
- email; for personal correspondence and attaching assignments
- listservs; another venue for class discussions
- database; for administering questionnaires, course evaluations, and gathering demographic information
- gradebook; for viewing up-to-date comments and assessment of submitted assignments

In addition to the interactive on-line tools, a number for methods of providing resources were experimented with:

- on-line course outlines
- Authorware or Director movies
- Powerpoint presentations
- pdf files

These types of files, thou neither interactive nor collaborative in nature, do provide a means for access of timely information. The course outline is provided on-line but other resources are included on the CD. The resources are linked off the web pages so that it is associated with the appropriate content. This has some advantages particularly with the pdf files in that information can be broken down and then linked to content pages in the course outline. In this way the content and the resources are much more closely linked. In addition, students can use these resources as background for future on-line discussions or comments.

Another product that was developed was an on-line database for tracking time spent on various components of the project by team members. This will be a tool for compiling important information about the economy of the project. In this way projections can be made about the cost in time and money to develop similar courses. Of course it must be recognized that startup expenses and time will always be higher for the initial offerings than for subsequent courses that take advantage of the previous research and development.

There are some secondary outcomes as well. The on-line tools represent some benefits for the learner. For instance, the instructor monitors the on-line reflections and this in turn provides quick turn around time for modifications, meeting student needs in a timelier manner. This also gives the instructor a sense for students' perceptions of and grasp of course content; this in turn is useful information for guiding instructional interventions. With the on-line reflections student comments were posted anonymously for other students to view. With this information students could spring board to take the discussion to a new level and this process also encouraged a sense of ownership in the content. There was a sense that because students were already on-line, they tended to use on-line research tools (search engines, ERIC) perhaps more than they would have normally. The listserv discussions became a platform for reflective discussion. It is the asynchronous aspect of listservs and newsgroups that provides some advantages, in that students submit reflective comments rather than off the cuff replies. Many of students in our Faculty take extended practicums in the field at a distance from our campus. Potentially on-line options could provide equal access and extended access to resources These can be made available in a timely manner, as needed by students in the field. Another potential benefit is that students can share resources with each other in a variety of ways. As an illustration, the project will have students compile a set of resources, ideas, lesson plans, or activities, in digital format and then provide these resources will be compiled onto a CD and distributed to all students. In this way students will continue to reference it after the course is over and represents a diverse set of ideas or resources. In addition the project is

experimenting with an alumni network to maintain linkages to the field with individuals who have taken our courses. This is a tool is an alumni listserv so that there can be ongoing discussions and correspondence. Through the use of the collaborative tools the paradigm begins to shift to a cooperative learning environment where sharing is valued rather than competition. For instance, students posted abstracts of the their thesis proposal to the newsgroup for comment and critique. It is important to make students accountable for what they do on-line; the lesson is, give them credit for involvement with the on-line tools.

This project also seems to have some value for instructors. For instance, there is an opportunity to merge research and scholarly teaching. Although not related to being on-line per se, the whole process fosters a reflective approach to the design of courses and helps make the activities the students are engaged in, are reflective of the goals. This comes about by rigorously mapping the objectives and goals to the activities. This was then monitored through online course evaluations combined with reflections. Another interesting side affect of putting courses online is that it becomes public. This makes the courses transparent by providing openness in the sense that anyone can now look at what the courses look like. The team approach contributed to the notion of scholarly teaching by the sharing of different perspectives. There was a sense that the quality of the course improved through the participation and shared vision of the team members.

Conclusions

Since this is a work in progress there are many issues and questions left unresolved or under investigation. These include the following issues.

Can we describe the characteristics of successful users of on-line courses? Are they independent learners or are there any significant differences? What are the common problems or barriers to success in on-line courses? Is it possible to document the asynchronous advantage of email, listservs, on-line reflections, and newsgroups?

Another issue is how on-line materials are used? Do student access all the materials, are the interactive components used effectively, if so, under what conditions?

To address some of these issues we hope to develop profiles on students and track the way they interact with the on-line materials. This combined with student comments, interviews, on-line reflections, quality of assignments, nature of the interactive messages (listserv, newsgroups, email), questionnaires, and case studies should give a better picture of the effectiveness.

In conclusion, there are some basic lessons that can be shared from the on-line project. Through student portrayals the benefits and frustrations of on-line courses are evident. However, this is requires more investigation and evidence. For the development of quality on-line courses it is important to develop a coherent project with a rationale, a mandate, and a planned strategy for success. Working in an interdisciplinary team facilitates the development of on-line course offerings. Regular meetings are important and there is a need for constant prototyping and revamping of materials. Another key element is staging the production process so there is sufficient time working up to a full-blown on-line offering. Approaching it in a graduated way was important for weeding out problems before they became critical. Another essential element is asking the question, why. Why use these tools? Constantly questioning the motives and rationale for selecting particular tools or strategies facilitates the culling process, which is necessary for determining appropriate technology tools to use.

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The Emergence of a Master's Program via Distance Learning in Teacher Education

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Due to declining enrollments and the advent of distance learning at our institution, the need for implementing a distance learning delivery system for our master's program in health, physical education, and recreation became apparent. This poster presentation will outline the steps that we initiated to incorporate a distance learning delivery system into an existing graduate teacher education program. In addition, we will reflect on how we addressed some of the following issues related to our discipline and our mission as a teacher training program. These issues included surveying not only the technological support of our institution but the technology needs of K-12 teachers, implementation of such an approach with our existing courses and the faculty teaching them, and the NCA accreditation process we went through in order to offer such an alternative delivery system.

Been There, Done That: Reaching Teachers Through Distance Education

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Abstract

Technology has become ubiquitous everywhere, except in schools. Although many schools are now acquiring the technology, not enough money is being set aside for professional development of teachers in the use of technology. Consequently, teachers do not feel adequately prepared to integrate technology into their daily practice. The purpose of this study was to examine the use of the World Wide Web and electronic mail as a viable option for the professional development of K-12 educators. Two classes were investigated, one delivered using the Web and another one in a face-to-face environment. Quantitative and qualitative methods were used in this investigation. The researchers concluded that distance learning is not an education of inferior quality to those university courses taught on campus, and that classes delivered on the Web provide a viable option for professional development.

Introduction

The latter part of the twentieth century has been marked by technology changes that are increasingly affecting every aspect of human life. We have left behind the industrial age and have now entered the information/communication age. The source of power in the information/communication age is knowledge (Drucker, 1994; Toffler, 1990). Drucker, (1994), who coined the term, "knowledge society," states that in such a society more knowledge, and especially advanced knowledge will be acquired well past the age of formal schooling, through processes that do not center on traditional school. We must become, out of necessity, a society of life-long learners.

With the collapse of the former Soviet Union and the end of the cold war, the United States has become the world leader in scientific advancements. However, in order for this country to remain competitive in the next century, a workforce that is highly skilled, especially in the use of technology, will be critical (U. S. Department of Labor Secretary's Commission on the Achieving Necessary Skills (SCANS) Report, 1991). It is increasingly clear that those who do not learn to think and work with technology today will be disadvantaged tomorrow. Vital to preparing the technological workforce of the next century is the classroom teacher. Yet, in many cases, the teacher feels and actually is unprepared to take on this technology task (Office of Technology Assessment, 1995).

Technology has become ubiquitous everywhere, except in schools. Although many schools are now acquiring technology, according to a national study conducted in 1995 by the Office of Technology Assessment (OTA), not enough money is being set aside for professional development of teachers in the use of technology. There has been little attention paid by districts to professional development needs of teachers, and Colleges of Education have not modeled its use for preservice teachers (Cuban, 1998). As a consequence, teachers do not feel adequately prepared to integrate technology into their daily practice. The design of new professional development opportunities in the K-12 classroom is very much needed. In doing this we must take into account that many teachers, especially in rural areas, have very restricted access to institutions of higher education. This situation has led them to attend summer school or, in the best of situations, to continue their education during the school year using distance learning. Because of the diversity of today's learners, it will be necessary to offer many forms of education such as distance education, evening and day classes, and online classes that cater to the needs of such a diverse population (Office of Technology Assessment, 1993). In support of this, Secretary Riley, in a speech delivered at the National Conference of the US Distance Learning Association (November 5, 1997), said that ".. technologies also are important for providing opportunities in higher education at a time when college is becoming more crucial.... making courses available at convenient locations; reducing time

constraints for course-taking; making educational opportunities more affordable; and increasing the institutions' access to new audiences." Recognizing the importance of distance education in the expansion of educational opportunities, this study investigates the feasibility for professional development of an already-existing resource in many classrooms: The World Wide Web.

Purpose

The purpose of this study was to examine the use of the Web and electronic mail (email) as a viable option for the professional development of K-12 educators. Two classes were investigated, one delivered using the Web and another one in a face-to-face environment. The uniqueness of this study is that the two classes shared the same professor, syllabus, and textbooks, but differed by the medium of delivery. By keeping the former variables reasonably constant, it was possible to look into the interaction that the students might have had with the medium of delivery. This investigation also attempted to answer some of the theoretical questions pertaining to distance education. For instance, Harasim (1990) suggested that there is a critical need for research that informs and guides future applications of the distance education field to make this promise a viable reality. Levinson (1990) stated the need to investigate and research some qualities of electronic text, such as its revisability, interactivity, duplicability, transmissibility, storage, and promotion of cognitive skills. Levin, Kim, and Riel (1990) proposed more research in the commonalities and differences of electronic networks and face-to-face interaction in the following areas: (a) group organization, (b) task organization, (c) interaction, and (d) evaluation and coordination. The results presented in this report shed light on the use of Internet-based telecommunications to support both professional development and life-long learning in a constructivist environment, and attempted to answer some of the questions posed by previous research studies.

Theoretical Framework

Constructivism builds upon the experiences that learners bring to the learning situation. In this sense, learning is a constructive process in which the learner is building an internal representation of knowledge based on personal experiences and social cultural contexts. Fosnot (1992) suggested that as learners interact with the environment, they are always growing, developing, and evolving in an organizing and adapting process called construction. The process of construction is more like the process of re-inventing; it requires the reorganization of old data and the building of new models. It is through this reorganization that the gaps, insufficiencies, or contradictions become apparent to the learner, facilitating reflection and accommodation. The use of Internet-based telecommunications supports a constructivist approach to learning because it provides the tools to increase the information available in the classroom in a frame of reflection and social learning (Perkins, 1992). However, if teachers are to support students in becoming reflective thinkers through the use of technology, the teachers must also have opportunities for engaging in experiences that promote a constructivist kind of learning (Wasser, 1996). Furthermore, in order for knowledge to transfer to situations beyond the classroom, learning must be situated in a rich context that is conducive to reflection (Bednar, Cunningham, Duffy, & Perry, 1992).

Every activity in which knowledge is developed and used is an integral part of what is learned, and situations are said to co-produce knowledge through activity. So, learning and cognition are fundamentally situated, and conceptual knowledge can be considered to be similar to a set of tools. Situated cognition has important implications for learning through technology use (Norton & Wiburg, 1998) because, by changing information tools, mental activity is usually altered and restructured. However, tools are generally used differently by children and by adults. Merriam and Caffarella (1991) stated that even though adult learning can not be adequately explained by a single theory, four components of adult learning can be extracted from all the existing adult learning theories. Those components are: (1) adult learning has a goal or characteristic of being self-directed or autonomous, (2) the content or triggers to learning are based on breadth and depth of life experiences, (3) reflection or self-consciousness monitors changes that take place, and (4) action or some other expression of the learning evidently occurs. Adult learning theories and constructivism share the characteristic of being learner-centered. For the purposes of this study web-based instruction was utilized because of its adaptability to constructivism.

Web-Based Instruction

The World Wide Web (WWW) is an exciting new medium for the development of classroom activities. Web-based instruction and hypermedia can be effectively developed as instructional tools based on the information processing theory and cognitive flexibility theory (Jones, 1997). Goldberg (1997) reported that the value of the WWW as a learning resource lies in its ability to bring students together through communication and collaboration. Web-CT, a web-based authoring tool to create online courses was utilized for this study. Some of the salient features of Web-CT, for course delivery, are the uses of bulletin boards, chat rooms, and presentation areas. The advantage of using this type of authoring tool is that it enables learners to explore non-linear relationships in a potentially rich graphic environment. This non-linear relationship allows for more than one way to explore topics, with the advantage that they can meet individual learning styles and needs (Jones, 1997). One way of approaching web-based instruction is through the constructivist paradigm, and a good exercise which is supported by such a paradigm is the WebQuest.

A WebQuest is an inquiry based learning activity in which learners interact with information that comes in part, or completely from the WWW (Dodge, 1995). WebQuests are designed to make the best use of the learner's time by providing a structured experience when using the WWW. One of the advantages of using WebQuests is that students have a stake in the learning process and focus their mental efforts in a positive direction. That is, this highly structured practice provides the learners with a clear task and resources for browsing the web and aides them in developing their own goals (Jones, 1997).

Methods and Data Sources

The main research question that guided this study was: Is the use of Internet-based telecommunications a viable option for university courses to address professional development practices for K-12 educators? In order to collect information and to understand how the participant (student) teachers constructed their knowledge and realities in both the online and the face-to-face classes, quantitative and qualitative methods were used. For the quantitative part, a pretest-posttest quasi-experimental design proposed to use the face-to-face class as a control group and the online class as an experimental unit. The Likert-scale survey instrument utilized consisted of three parts. The first part collected demographic information. The second part was the Instructional Strategies Frequency and Effectiveness Inventory (ISFEI) developed by Alexander (1988) and modified by Harvey (1991). This instrument investigated the (student) teachers self-reported frequency and effectiveness of teacher-oriented, student-oriented, and technology-oriented instructional strategies. The third part, the Stages of Concern about the Innovation Questionnaire (SoCQ) developed by Hall, George and Rutherford (1977), gathered data on the level of teacher concerns about technology integration as a change or innovation. Also, as part of the quantitative research, a rubric based on a five-point scale from "poor" to "excellent" was used to evaluate (student) teacher-produced WebQuests as final class products.

For the qualitative part of the study, three sources of data collection were used. The first data source was a modified version of the Middle and End of the Semester Course Analysis, an email-delivered, open-ended questionnaire originally developed by Weber (1996). This questionnaire investigated the participant (student) teachers' class perceptions, and the perceived level of class satisfaction. The second data source consisted of in-depth interviews with a selected sample of participants from each class. These interviews were conducted using traditional face-to-face methods and online chat rooms. The third data source was the participant (student) teachers' electronic journals.

Results and Conclusions

A 2-sample *t*-test was used to analyze change in the ISFEI self-reported frequency and effectiveness of instructional strategies. While no change was found in the use of teacher-oriented and student-oriented strategies, a slight increment was shown in the use of technology strategies. The SoCQ was analyzed using a rank sum test. This analysis demonstrated that teachers moved from early stages of awareness to concerns about the assessment of the impacts of technology for student learning. The analysis of this survey as a whole showed no significant difference between the two investigated settings, reaffirming the notion that distance education

can be, and actually is, a viable alternative to continuing education and useful for professional development purposes.

A signed rank test was used to analyze the class products (WebQuests). No significant difference was found in the quality of (student) teacher-produced WebQuests. Two of the WebQuests from the online class were rated as the best in the two classes, but another product in this same group was rated as one of the worst in both. At best, this is a very mixed result and it cannot be concluded that the online class leads students to produce projects of better quality. Although the situation emphasizes that a distance education class can be as rigorous as one conducted in a face-to-face setting.

As with most inquiries, qualitative methods provided useful insights in understanding the dynamics and differences between face-to-face and online classes. While students in the face-to-face classroom perceived the class professor mainly as a source of knowledge, students in the online class sensed her as a guide on the side. Another important difference was that online students reported using more problem-solving strategies and described the class as one that encouraged "finding their own answers." Group work was another important topic in the online class. As with almost any class, groups that did not work together were present in both the face-to-face and the distance education class. However, by the end of the semester, (student) teachers in the latter reported that group work was very important and they felt that they had really built a community of learners.

Online interviews conducted synchronously (in real time) in the chat rooms were an innovative way of in-depth interviewing. While in a face-to-face setting the interviewee can expand on a topic, online interviews proved to be succinct but very informative, supporting previous findings of electronic-collected data (Synodinos & Brennan, 1988). That is, quantity of data was substituted by reflective and to-the-point answers. One possible reason is that the participants could reflect more on the questions and their answers because they were available on the computer screen.

Using electronic journals was another strategy for data collection utilized in this study. Online participants wrote longer and more reflective journals than the face-to-face ones. One reason may be that for distance education students, electronic journals were a way of keeping in touch with the professor and building the feeling of "being in a class."

Educational Importance of the Study

In the midst of the information age, society needs more technology qualified teachers to prepare its workforce. In this study, distance learning was not found to be an education of inferior quality to those university courses taught on campus. However, successful face-to-face teachers do not necessarily make successful online instructors. Professional development at the university level is needed to provide distance learners with the quality that post secondary courses require and demand. Classes delivered on the Web provide a viable option for professional development, especially for those whose access to institutions of higher education is difficult or inconvenient. Additional research is necessary to compare and evaluate the viability of online synchronous interaction for in-depth interviewing.

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Virtual Teacher Education: Affordances and Constraints of Teaching Teachers Online

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Abstract: This paper draws from both an examination of the formal characteristics of online environments and the authors' experiences offering educational technology courses within such environments to discuss the potential of asynchronous distance education to support and/or constrain professional development.

All media are selective. Each medium of communication emphasizes, amplifies, and enhances particular kinds of experience. Each medium of communication privileges particular ways of knowing. These things we call affordances. The very same medium, at the very same time, also inhibits, restricts, and diminishes other kinds of experience. All media thus marginalize particular ways of knowing. These we call constraints. All media both afford and constrain teaching and learning in their own particular ways.

At the University of Albany, we are engaged in creating asynchronous online versions of our educational technology courses using the World Wide Web (WWW). In fact, we will offer a Masters Degree in Instructional Technology completely over distance by the fall of 1999. Even as we agree that, especially in the technology areas, this is a plan whose time has come, we worry about pedagogy. How can we use this new electronic medium to its best advantage? How can we change what worked well in a classroom so that it works at all online? Can teachers, among the most human of professionals, ever become comfortable with learning that separates them in both space and time, from their professors and classmates? Clearly, we aren't in Kansas anymore.

This paper looks at formal characteristics of WWW-based environments in terms of their inherent potential to support and/or constrain learning, and in light of our own experiences teaching online courses for the past two years. We begin by setting our observations in perspective and end with some reflections on them.

Perspectives

In 1964, Marshall McLuhan wrote that the age of print which had dominated Western culture for five hundred years was coming to an end, and that with it, print-based ways of thinking, being, and educating would be replaced by electronic ones. He based his arguments on the societal changes that accompanied the great media revolutions of history. Most 'serious' thinkers ridiculed his ideas. His disciples (e.g., Eisenstein, 1983; Ong, 1982; Logan, 1986), however, found evidence in the historical record to support his claims. Changes in educational practice resulting from changes in communications media have been particularly well documented.

Today, McLuhan is all but forgotten by most Americans, but his ideas have gained widespread acceptance. Today, many scholars (e.g., Bolter, 1991; Landow, 1992; Lanham, 1993: Aarseth, 1997) and researchers (e.g. Kozma, 1993; Reinking, 1994; Haas, 1996; Turkle, 1997; Murray, 1997) believe we are indeed poised on the cusp of a new media revolution. Many of these scholars have focused on what they see as the affordances of the medium, on what electronic texts enable us to do. There are also those, such as Joseph Weizenbaum (1976), Neil Postman (1993) and Sven Birkerts (1994), who have urged us to examine the constraints electronic texts impose on us, on what electronic media make difficult, impossible or simply irrelevant. Others, (e.g., Harasim,

1990; Keye, 1992; Hiltz, 1994, Eastmond, 1995; Garner & Gillingham, 1996; Haas, 1996) have simply urged us to look closely at what new media actually afford and constrain.

Formal Characteristics: Print vs. WWW

Education as we know it is a product of print. The print revolution enabled the development of the lecture-and-text-based form of education most of us practice today, as well as many scholarly practices we take for granted. Printed texts, for example, encourage private engagement. Before print, all reading was reading aloud. Printed texts impose a linear order on thought in which the basic movement is forward and the basic logic is progressive. Print thus affords syllogism, but constrains association. Printed texts are static, permanent, univocal, and authoritative. Notions such as intellectual property and the ownership of ideas accordingly came into being with the development of printed texts. Such ideas were unknown to the ancients.

WWW-based texts, on the other hand, are non-linear. Movement within them is lateral and the basic logic is associative. WWW-based texts encourage public engagement within a web of connectedness. WWW-based texts are malleable, emergent, polyvocal, and provisional. WWW-based texts include a variety of media and are as much graphical as textual. As we begin to explore educating with and through such texts, we must wonder at these formal distinctions. In particular, we must ask "what new strategies for teaching and learning are necessitated the unique characteristics of WWW-based texts?" as well as "what 'tried-and-true' pedagogical methods must we abandon therein?"

Although there are several excellent studies of online education (e.g., Harasim, 1990; Hiltz, 1994, Eastmond, 1995; Garner & Gillingham, 1996), most of these deal with learning supported by computer-mediated communication (e-mail, listservs, newsgroups), not learning situated in asynchronous WWW-based environments. Similarly, although a great deal has been written about the characteristics of WWW-based environments and their potential to support learning (e.g., Aarseth, 1997; Gilster, 1997; Joyce, 1998; Reinking, et. al., 1998; Snyder, 1998), very little actual research on such use has yet emerged.

Practical Experiences: SUNY Learning Network

The Department of Educational Theory and Practice in the University at Albany School of Education began developing an online masters degree in instructional technology two years ago. We are working through the SUNY Learning Network (SLN), an organization serving all the State University of New York schools which provides the servers and Lotus Notes templates for our courses as well as a common interface and gateway to them. This allows us to concentrate on teaching and learning. Thus far, we have developed and taught graduate level courses in *Language, Literacy and Technology, Computing in Education, Systematic Design of Instruction, Media in Teaching and Learning, Teaching in Context*, and *Web Design for Education*.

Our experiences adopting our courses and our teaching methods have forced us to consider the ways in which characteristics of online learning environments afford and constrain the educational process. In particular, we are concerned with the potential of such environments for bringing professional development directly to inservice teachers in their schools and classrooms. In the section which follows, we examine the potential of particular formal characteristics of WWW environments for teaching and learning in light of the practical understandings we are gaining from our online teaching experiences.

Characteristics of WWW-Based Learning Environments

Online Learning is Asynchronous

The most obvious characteristic of the WWW environments in which we teach is that they are asynchronous. Professors and students are separated from one another by both space and time. On the one hand, this makes online courses accessible to a range of students for whom they might be otherwise unavailable. Our courses, for example, have been attracting education professionals from around our state. They are also particularly attractive to our regular students, the majority of whom are practicing teachers with afterschool and familial responsibilities. An added benefit of accessibility is that learners can attend to their lessons when they are most

capable of the mindfulness that makes such attention most profitable. Asynchronicity thus seems to nurture a culture of reflection. Participants, for instance, can review the course of a discussion before contributing to it, and reflect on their own contributions before posting them.

On the other hand, asynchronicity makes face-to-face communication impossible. The loss of face-to-face communication makes it extremely difficult to negotiate ideas. Everything that might be included in a lecture must be explicitly spelled out. Directions must be over written. At the same time, our own research on how people 'read' WWW pages (Swan, et. al., in press) indicates that people don't read text on the screen from start to finish the way they might read printed text; rather they skim and scan it. This and the lack of physical context means that concepts must be presented as self-sufficient and self-contained. Text must be broken into small, single idea sized pieces (generally no more than two or three simple sentences long), and most important concepts highlighted.

The loss of face-to-face communication also means a loss of the personal. One aspect of this – the communication of caring -- seems particularly important to our students. Caring, we are finding, must be verbalized online. Our students, for example, have told us they want to be addressed by name, and our preliminary analysis of asynchronous discussions indicates more caring words and concepts than are typically found in real-time classroom discussions. On the other hand, the lack of face-to-face communication seems to encourage people to take greater communicative risks. Participants in asynchronous discussions seem more likely to share personal opinions and relate personal experiences to ideas and concepts. In addition, the lack of face-to-face communication circumvents biases of all sorts; ethnicity, gender, age, class are less important online than the quality of one's ideas. Some authors (e.g., Weizenbaum, 1976), however, have argued that computers are also value free and so encourage 'instrumental reason.'

Online Discourse is Polyvocal

Indeed, discourse in asynchronous online environments is significantly different from regular classroom discourse. Because it is asynchronous, for example, everyone has a voice, and everyone's voice is relatively equal. Online discourse is thus polyvocal and democratic. What is lost therein is the authority of the instructor. It is difficult, if not impossible, for an instructor to lead discussion in a particular way. In general, therefore, online discussion lacks depth. What it lacks in depth, however, it gains in breadth. The majority of students in our courses, for instance, are practicing teachers whose teaching contexts, subject areas, and time teaching are quite diverse. They thus bring a wide variety of experiences and viewpoints to bear on any issue, enriching understanding in ways a professor alone cannot. Some of our students write:

> *Student participation was all online discussion. I found this much better than I had guessed it would be at the beginning of the term. Being able to reflect before responding and being able to look forward and backward in a discussion was very beneficial.*
>
> *I really enjoyed the online discussions. Students who normally would not participate in class did; people who normally would dominate discussion couldn't; and you could focus on discussing the specific things you were interested in. I really had to think a little deeper than usual about some things which was nice.*
>
> *The discussion aspect has given me the opportunity to express my own personal views on the topics covered. It gave me the chance to reflect on prior experience and knowledge. I enjoyed the opportunity to interact through intelligent and sometimes playful conversation with fellow classmates.*

In fact, Jiang and Ting (1998) found that student satisfaction with online learning could be directly correlated with the amount, authenticity and value placed on class discussions.

Online texts are also polyvocal in that they support multiple symbol systems. Multiple symbol systems, in turn, support multiple representations of knowledge. Veenema and Gardner (1996) maintain that such multiple representations of knowledge can stimulate and help develop our multiple intelligences, especially those nonverbal, non-analytic intelligences consistently marginalized by traditional education. In practice, however, graphical, audio and video representations are currently very demanding of computing resources. Thus their inclusion in online courses can affect access. In addition, the logic of nonverbal systems is different from that of verbal logic. Kress (1998), for example, contends that "arrangement and display are the essential features of

the logic of the visual" (p. 69). Many of us, designers and learners, who have grown up equating 'logic' with 'verbal logic' must learn to understand and employ nonverbal forms of argument.

Online Texts are Ergodic

Espen Aarseth (1997) characterizes online texts as ergodic, "a term appropriated from physics" to indicate texts in which "nontrivial effort is required to allow the reader to traverse the text" (p. 1). Online texts must be 'navigated,' a reality that can lead, on the one hand, to quasi-concret and direct interactions with the structure of the knowledge covered (as conceived by the course designer), or, on the other hand, to the disorienting perception of being 'lost in hyperspace.' In the case of online discussion and course assignments, texts are also emergent and malleable. Jiang and Ting (1998) argue that the importance of authentic discussion in online courses is related to just this, to the fact that knowledge is explicitly socially constructed therein in ways only subtly suggested in regular classroom learning. Learning online thus forces students' active participation. Some of our students write:

> *Online learning involves all the students in active participation in the course unlike in a conventional classroom. This is one of the most important aspects of online learning.*
>
> *I feel that I had many opportunities to be a part of my learning process – more than in other classes. In a traditional setting, students usually don't get to participate as much, but in this class I felt like I took a much more active role in my own learning.*
>
> *Today I helped someone subscribe to a newsgroup. Here is proof your 'discovery learning' is working! By struggling through it myself I actually encoded the processes and remembered it! If it was presented in a lecture or hand-out I would not have been able to do it without pulling out the papers, etc. Hence, I am learning! Yeah!*

Because we teach about technologies and practices that will continue to evolve and emerge in the foreseeable future, we feel very strongly about teaching our students to learn on their own. In the online environment, we cannot 'show' them how to do something, or do it for them. They must learn for themselves. While at first many students complain they aren't getting their money's worth, most are pleasantly surprised and technologically empowered by the end of the semester. In a similar vein, we also take advantage of the malleability of the medium to allow students to revise their work for more points.

The WWW is Open and Rhizomic

Vannevar Bush (1945), who envisioned the WWW long before there were computers to support it, was particularly interested in externalizing and extending the 'linking by association' he believed characterized human thought. Indeed, Gunter Kress (1998) characterizes the organization of the WWW as 'rhizomic,' as a web in which every point can be connected with every other point. These linking capabilities afford new levels of connection and integration. Links within course make connections between topics explicit. External links give access to the vast information resources of the World Wide Web. Of course, as Sartre has noted, too many choices can be the ultimate tyranny; too much information is tantamount to no information at all. Just as we have all been overwhelmed by information overload, we must all designers and students be careful to neither encourage or succumb to it in our teaching and learning.

In any case, WWW-based courses afford the logic of association and connection. At the same time, they constrain syllogism and hierarchical structuring; they constrain logical progression and linear explanations. Not only can students move through sets of materials in online courses in multiple ways, we have found that they are likely to 'read' single documents non-linearly (Swan, et. al., in press). They are likely to use some form of what Burbules (1998) and others have called 'bricolage,' to mentally assemble pieces of texts in multiple relations to one another when making sense of the whole.

The associative affordances inherent in WWW-based teaching and learning environments have been for us perhaps the most difficult to fully utilize. We suspect that habits of mind formed over decades of teaching are very difficult to change. We are especially unwilling to let students pick and choose among our words of wisdom, and, after all, the structuring of information, the creation of knowledge is what we get paid to do. Some of us have been experimenting with a portfolio-based assessment that allows students to complete a set of

activities and demonstrate certain competencies in whatever order they find reasonable. It seems to be working quite well.

Summary and Reflections

Figure 1 below summarizes the affordances and constraints of the asynchronous WWW-based environment we are using to support our online courses identified in the body of this paper.

ASYNCHRONOUS ONLINE ENVIRONMENTS . . .

AFFORD	CONSTRAIN
access	context
mindfulness, reflectivity	interpersonal communication
personal expression	bias, values
equity, multiple perspectives	authority, narrative
breadth	depth
multiple symbol systems	consistency
construction of knowledge	instruction
association, connection	syllogism, hierarchy
bricolage, juxtaposition	logical progression of ideas

Figure 1: Affordances & Constraints

Perhaps the first thing that comes to mind in reviewing these lists is that the affordances of online environments seem particularly postmodern. We find that somehow encouraging. Especially in the field of educational media, we should be exploring postmodern pedagogies. We also find it encouraging that these affordances seem to map to the constructivist epistemologies which go hand in hand with educational computing. We believe it is important that we practice what we preach.

Our students tell us they are satisfied with the online courses, most especially the access they afford. Most miss face-to-face communication, but I am sure we would be disappointed if they didn't. What we are unclear about is also what we are most interested in – the efficacy of online teaching and learning for professional development. In particular, we have been thinking about the relationship between the distance in time and space between professional development activities and classroom practice and wondering whether virtual proximity approximates the real thing. Future research will be in this direction.

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Pioneering On-Line Degree Programs For Teachers: The Risks, Roadblocks, and Rewards

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Abstract: This paper describes the process of establishing an Internet-based on-line graduate degree program for teachers. At Webster University, this program was the first on-line degree to be offered by the institution. The paper reviews Webster University's experiences and outlines a planning process that includes defining the rationale (risks), developing the major components (roadblocks) including courses, approvals, facilities, instructor and student support, and evaluation. The lessons learned (rewards) are summarized and recommendations are given for other institutions that wish to launch on-line degree programs for teachers.

1. Introduction

1.1 Overview

The School of Education at Webster University (St. Louis, MO) recently joined other institutions in launching Internet-based on-line teacher education programs (Hammon and Albiston, 1998). Faculty in the School proposed the University's first fully on-line degree programs after several years of experimenting with teaching strategies using the Internet.

When considering the risks, roadblocks, and rewards of providing on-line programs, various issues and components need to be addressed concurrently. This paper outlines these issues and components as defining the rationale (risks), planning and development (roadblocks), and the lessons learned when Webster University launched its new on-line teacher education programs (rewards). This paper also makes recommendations that may apply to other universities developing similar programs.

1.2 The Institution

Webster University is an independent, comprehensive, nondenominational, multicampus, international university with accredited undergraduate and graduate programs in various disciplines including teacher education, business, management, liberal arts, and fine arts. Webster University offers day, evening, weekend, and on-line programs at its home campus in St. Louis, Missouri, and through its extended campus network at 75 locations in the United States, Europe, and Asia. The School of Education is one of five academic units in the University. It enrolls 150 undergraduate and 1000 graduate students in three centers in Missouri (St. Louis, Kansas City, River Heritage). School of Education programs include bachelor degree programs in early childhood, elementary, secondary, and special education; and Master of Arts in Teaching Degree programs in communications, early childhood education, educational technology, mathematics, multidisciplinary studies, science, social sciences, and special education.

2. Defining the Rationale (Risks)

The high-profile nature of on-line degree programs requires an institution to define a clear rationale for these programs. The rationale needs to include why this institution should offer on-line courses, which departments should offer on-line programs, and which particular programs should be offered on-line. With the Internet already established as a reliable, versatile, and accessible medium of communication, commerce, and education, it is timely that teacher education programs use this medium for the delivery of degree programs and courses.

Webster University found a rationale in its mission statement. Relevant points in the statement included directives to: "Create a student-centered environment accessible to individuals . . . sustain a personalized approach to education . . . and to provide graduate programs that allow students to achieve the best education for each individual's particular talents, interests, and goals in an environment that emphasizes service to students."

The rationale for Webster University's School of Education to offer on-line programs was to reach wider audiences, especially outside Missouri; to model progressive teaching strategies; and to provide leadership of using on-line delivery methods across the University.

Two Master of Arts in Teaching (M.A.T.) degree programs were initially selected for on-line delivery: Educational Technology and Multidisciplinary Studies with Emphasis in Educational Technology. The rationale for choosing these programs was that they model and mirror much of the content of these programs. Students learn about developing their own on-line courses and programs through first-hand experience of learning in the on-line format. Educational Technology students are familiar with the Internet. Most of them already integrate use of the Internet in their classrooms. Many schools are ready to, or are positioning themselves to be ready to, incorporate on-line (distance education) courses into their curriculum.

3. Planning and Development (Roadblocks)

The planning and development of on-line degree programs require the coordinated involvement of many individuals and offices within the institution. There are policies to clarify or make, technical and academic problems to solve, and logistics to manage. These issues can be discussed in terms of: (1) courses, (2) approvals, (3) instructor support, (4) facilities, (5) student support, and (6) evaluation.

3.1 Courses

In determining which courses will be delivered on-line, developers need to consider whether the courses are appropriate to the medium, are required for a degree, and preserve the integrity of the program. Scheduling the courses with instructors who are willing to teach on-line is also a factor.

In evaluating courses for the on-line programs, Webster University faculty found 14 potential courses that would constitute the first degree program cycle (Tab. 1).

<table>
<tr><th>Semester</th><th>Educational Technology MAT</th><th>Multidisciplinary Studies MAT with Emphasis in Educational Technology</th></tr>
<tr><td>1 (Summer)</td><td colspan="2">Curriculum Design (common course, cross-listed)</td></tr>
<tr><td rowspan="2">2 (Fall)</td><td colspan="2">Contemporary Educational Issues (common course, cross-listed)</td></tr>
<tr><td>Building Web Pages</td><td>Interpersonal Communications</td></tr>
<tr><td rowspan="2">3 (Spring)</td><td colspan="2">Collaborative Learning Strategies (common course)</td></tr>
<tr><td colspan="2">Instructional Media (common course)</td></tr>
<tr><td>4 (Summer)</td><td>On-Line Course Design</td><td>Comparative Educational Systems</td></tr>
<tr><td rowspan="2">5 (Fall)</td><td colspan="2">Distance Learning Strategies (common course)</td></tr>
<tr><td>Planning Educ. Technology Facilities</td><td>Evaluation</td></tr>
<tr><td rowspan="2">6 (Spring)</td><td colspan="2">Technology and Thinking Skills (common course)</td></tr>
<tr><td colspan="2">Leadership Issues (common course)</td></tr>
<tr><td>7 (Summer)</td><td colspan="2">Instructional Design (common course)</td></tr>
</table>

Table 1: Proposed Initial Course Sequence of On-Line Programs

The School of Education selected one of these courses, Curriculum Design, to pilot the on-line format. The experiences in this course were expected to further guide the development of the on-line strategies used in other courses. (Webster University School of Education, 1998).

3.2 Approvals

3.2.1 Internal Approvals

While policies about approvals of on-line programs vary across institutions, it is necessary to enlist cooperation and support of numerous administrative offices and faculty. On-line programs require involvement of such offices as computing and network services, registrar, libraries, media services, academic advising, and extended campus personnel. Faculty approval bodies scrutinize new programs, inevitably mixed with other agendas such as the competition for budget resources. Conflicts also arise when no policy exists or when the application of a policy to on-line degrees is vague. It is essential to plan for all levels of information sharing, approvals, and the enlistment of cooperation or participation on campus. Since current academic policies at most institutions are developed only for on-campus formats, they typically require clarification for on-line programs. Such policies may include admission, registration, course attendance, academic conduct, grading, and the articulation of on-line courses with on-campus courses. Faculty policies such as qualifications, intellectual property rights, load, and compensation also need review.

Webster University administrators encouraged the development of on-line degree programs in each academic unit (Schools). Initiatives for developing on-line degree programs were assumed by several faculty members in each School. These faculty teams provided regular progress updates about the emerging on-line programs at faculty meetings, campus committee meetings, and with postings on the University's Intranet. These presentations and updates were valuable in raising faculty awareness and building a supportive consensus for the on-line programs. At Webster University, new courses, emphasis areas, or degree programs require approval by the School or department faculty, and the University's graduate curriculum committee. Most academic policies that the School of Education faculty reviewed remained unchanged. Policies on course conduct, transfer of credit, directed studies, independent study, credit by examination, grading, advancement to candidacy, honors, academic warning, probation and dismissal were not affected by delivering the program on-line. Polices that needed to be modified, included the admission policy, and policies on registration, enrollment, loads, course attendance, and grievances.

3.2.2 External Approvals

Regional accrediting bodies require institutions offering on-line (distance education) degree programs to adhere to standards of good instructional practice. Each regional accrediting commission sets its own requirements, guided by the Western Interstate Commission for Higher Education (WICHE) Principles (Commission on Institutions of Higher Education, 1997). Institutions are required to document how they expect to address these principles.

Webster University is accredited by the North Central Regional Association of Colleges and Schools (NCA). One of NCA's curriculum guidelines is: "Programs provide for timely and appropriate interaction between students and faculty, and among students." (Commission on Institutions of Higher Education, 1997) To address this guideline, Webster University assures that "All on-line courses will involve interaction between students and faculty, and among students using email, small group and whole class discussion forum. Some classes will also include audio or video conferencing." (Webster University School of Education, 1998)

In addition to the regional accrediting bodies, some state coordinating boards for higher education and the boards for elementary and secondary education require additional approvals for on-line degree programs. State commissions may require review of on-line teacher education courses that are applicable to state certification, licensure, or to teacher professional development.

3.3 Facilities

On-line programs put new demands on an institution's campus facilities, including its technology infrastructure, libraries, and media and computer centers. Technology infrastructure refers to workstations, servers (web, email, ftp, streaming audio, video, and multimedia), networks, and Internet access. This infrastructure requires a long-range plan and design, as well as on-going maintenance. There needs to be sufficient personnel to attend to the infrastructure, as well as to provide the necessary support to faculty and students. Academic libraries must be available to the on-line student. Although some library resources may be available on the Internet, many reference or research resources are currently only available in hard copy. This means students must be able visit a library in person to complete research assignments. Traditional on-campus students have access to media and computer centers, where they can check out camcorders or digital cameras, or use video editing facilities or high-resolution scanners for their assignments that require media use. On-line students should also have comparable access to the same tools and facilities to complete assignments.

Webster University already had a technology infrastructure in place. However, it contracted consultants to install additional servers to accommodate the on-line courses. Webster's extended campus network provided the advising, registration, labs, and technical support services for the on-line courses. In many states, students could obtain library access to public university libraries. Where this is not available, Webster University arranged cooperative library agreements with university or college libraries in the geographic vicinity of on-line students. Media and computer center support services were available at the various extended campuses.

3.4 Instructor Support

3.4.1 Training and Assistance

Since most faculty may not have experience teaching on-line, training is critical. This training must include the instructional design of on-line courses and the management of materials, course activities, and student interaction. Instructors must learn to use course management software, conferencing or group discussion software, as well as other software tools and templates that facilitate course delivery. Instructors must also be provided with media construction assistance and on-going technical support.

Webster University contracted instructional design consultants to provide the training for faculty as well as the course management and conferencing software, templates and tools for all on-line courses throughout the University. Decision-makers believed this approach to be more cost-effective and lower risk of failure than assuming these tasks internally.

3.4.2 Intellectual Property Rights

While instructors' intellectual property rights are taken for granted for on-campus courses, the parameters of intellectual property rights for on-line courses seem less clear. Instructors need protection of their intellectual property rights in their courses. Some institutions already have policies developed, which can be applied to on-line courses. Many others do not. Academic governing bodies must formulate institution-wide intellectual property policies to protect the parties involved.

Webster University did not have any intellectual property rights policy in place. The policy that Webster University is developing includes: (1) principles underlying the policy; (2) articulation of the rights and responsibilities of authors, creators, inventors, and the University; (3) the various categories of ownership such as traditional works, university-sponsored works, and externally-sponsored projects; (4) designation of an administrative area to coordinate intellectual property issues; and (5) declaration of the rights and responsibilities of students.

3.5 Student Support

The on-line format may attract students in larger numbers. In addition, the students may be from geographical locations beyond the traditional reach of the campus. Therefore, in order to provide appropriate student support, it is necessary to identify the unique needs created by the on-line format. Student services that may need to be addressed are enrollment, academic advising, and registration.

Different ways of accessing library services and obtaining technical assistance may also be necessary.

Webster University's on-line programs attracted new graduate students at the home campus, the extended campuses, and other geographical locations. At the home campus, the additional student services needed as a result of the increased enrollment were met with exiting resources. The University's extended campus network was called upon for the additional student services required beyond the home campus.

3.6 Evaluation

An on-going evaluation of the effectiveness of an on-line program is necessary to justify the endeavor. Enrollment and retention figures are good indicators of student interest. Student feedback provides more details about student satisfaction and appropriateness of teaching strategies employed in the on-line programs.

Webster University's evaluation component includes the same tools used in traditional on-campus courses. The projects, papers, and exams assigned are the same in both the on-line and on-campus versions of the courses. Team planning occurs in some on-line courses, enabling instructors to critique each other on the appropriateness and effectiveness of the on-line teaching methods. Enrollment and retention statistics are tracked separately for on-line and on-campus sections. Student evaluation include on-line journal writing that include comments about the course format, in addition to a standard course evaluation form used in all courses (on-line and on-campus).

4. Lessons Learned (Rewards)

What lessons were learned from Webster University's experiences in launching on-line teacher education courses? First, on-line courses seem to sell themselves. No additional, or special, marketing is necessary to attract students. The interest that on-line courses generates not only results in higher enrollments, but also increases the visibility of an institution's programs. This increased interest and visibility can elevate the profile level of an institution.

Webster University found that the on-line approach to course offerings was congruent with its mission statement to create a student-centered environment, to sustain a personalized approach, and to emphasize service to students. During its first registration period, Webster University's enrollment for the pilot on-line course reached its maximum quickly. These students were from various majors, not just the Educational Technology major. There were several reasons that these students chose the on-line courses over the traditional on-campus courses. The most common reason was the convenience of the delivery format. The asynchronous nature of on-line courses enabled students to take these courses in addition to their normal load. Other reasons students cited for choosing on-line courses included interest in the medium and greater ability to customize a course to their individual needs. One of the biggest rewards among both students and faculty was to have been among the first to participate in an exciting, new approach to graduate teacher education.

Will other institutions experience comparable risks, roadblocks and rewards as Webster University did in starting new on-line programs? The answer will depend on how the institution and individuals within it perceive and deal with innovation and change. Institutions that attempt to launch new on-line degree programs will probably find some institutional support in place. However, there are likely to be many challenges and roadblocks, which heighten risks for failure or potentially compromise the quality of the on-line program. Based on Webster University's experiences in starting on-line degree programs for teachers, the following recommendations are suggested for other institutions:

- Identify a program development team and team leader. The commitment of several key individuals is critical in guiding the development through the maze of issues, the resistance to change, and the complexities of design components.
- Prepare a well-defined development plan and secure commitments from administrators for this plan. The plan should include a strong rationale for the on-line program and details about the courses involved, how the instructors will be trained and supported, the anticipated approval processes, and the technological and organizational infrastructure changes required.

- Enlist broad participation and share information. Consider the program development process as a training or professional development for the faculty. Every discussion or presentation is an opportunity for them to increase awareness and knowledge about the nature of and methods used in on-line courses.
- In developing intellectual property policies, consult policies from other institutions, as well as legal experts in intellectual property.
- Pilot one or more on-line courses before launching a full degree program. The pilot course should be an additional section, rather than a replacement of an on-campus course.
- Outsourcing technical and training support components for on-line courses can be less risky and more cost-effective than committing in-house resources.

Delivering courses and programs on the Internet is one of several new technology directions that institutions are ready to explore, if not eager to embrace. Whether the institution is comfortable with change and innovations or not, the work to start on-line programs is challenging across-the-board: The institution's philosophy and mission statement must be examined. Policies must be created or modified and approved. Curriculum and courses must be updated. The organization's infrastructure must be strengthened. Technology resources must be expanded. New training, support, and assistance for faculty must be instituted. Student services must be broadened. In effect, the institution itself could be transformed as a result of starting one new on-line teacher education program. With wise planning and careful development, this transformation will be happily welcomed as an important benefit to students, to faculty, and to the institution itself.

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Do We Know How to Speak Online?

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Abstract: CMC issues are omitted by most educators while integrating computer technology into classrooms. What problems are produced when attention to CMC skills is neglected? From the multicultural aspect, what issues should be examined? How should CMC be integrated into the current instructional technology curriculum? These questions must be answered prior to integrating CMC into instruction.

Entire curricula are currently available through web courses. This useful technology has been introduced into the classroom; but one important step has been omitted, teachers are not educated in the use of this technology. A training program for teachers must include strategies designed for computer-mediated instruction and CMC workshops must be provided for in-service faculty. Students should receive instruction that will equip them to design and teach web-based courses and instruction in using the computer to communicate with students. A major issue when using CMC in instruction is that a facility in writing is essential for the entire curriculum. CMC, if used effectively, motivates students to become involved in authentic projects and encourages them to write for a real audience of people in the larger world community, not just composing assignments for the teacher. Some students are unable express themselves well in writing, and, even for those who can, the act of writing and using online text-based applications can be a time-consuming struggle.

CMC, being a text-only means of communication, avoids such structures as social role, rank, and status. Research suggests that CMC is less personal than face-to-face communication (Hiltz, Johnson, & Turoff, 1986). It is impossible to know how long it took someone to draft an on-screen response. Responses are judged by the ideas and thoughts conveyed, more so than by who is doing the writing. Because the medium lacks social cues and the fact of its asynchronous nature it affords everyone an equal opportunity to participate (Walther, 1992). The CMC user must have some skill in reading and writing. The nature of CMC is currently grounded in its emphasis on English writing skills. From the multi-culture aspect, writing in CMC is an important issue. Written communication can be a tool for either cultural domination or cultural survival. For cultures that have historically transmitted their teaching through oral traditions, such as native Americans, the use of English text introduces a huge disadvantage for the student. The lack of computer writing/typing skills is an important omission in current instruction technology curricula. In virtual classrooms, students and teachers will communicate primarily through the written word. Writing must be emphasized throughout the curriculum. In graduate level classes on CMC, students must examine the medium and assess the impact of CMC on the writing process and its outcome.

Writing skills play a vital role in CMC, particularly in the virtual environment. The virtual classroom has arrived. A growing number of teachers are utilizing this medium in lieu of meetings. Undoubtedly, CMC skills and writing skills must be integrated into teaching education programs.

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Attitudinal Roadblocks: Transitions to the Distance Classroom

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Abstract: Distance learning via compressed video is a major direction institutions of higher learning are headed in. From the standpoint of the institution, a course can be offered to a larger number of students at a reduced cost. Students are also accommodated by not having to drive to a central campus. This research explores the impact of distance learning via compressed video on the student in terms of student perceptions. It also explores personality characteristics that facilitate student acceptance. Students were sampled at two geographically diverse universities. Results are interpreted from a psycho-educational perspective.

Introduction

Research suggests that advanced educational technologies can go far toward creating complex and rich learning environments at the college level (Clariana, 1993; Freedman & Liu, 1996). One of the more prominent technologies supplementing and in some cases replacing tradition instruction at the post-secondary level is distance learning via compressed video. Distance learning involves an instructor providing a class not only to the students in her/his classroom but also students receiving instruction through two-way video and audio interaction at remote sites. Even though students at the remote sites are not physically in the classroom, they benefit through on-line, real time communication with the instructor, just as the students physically in the classroom do.

There are several benefits to distance learning worthy of note (Klein, Knupfer, & Crooks, 1993). Colleges and universities can save money by offering courses to a larger variety of students more inexpensively than is currently the case. The instructor can reach more students than was heretofore the case. Students who do not live close to a campus can take classes for college credit at remote sites, thus saving them the hardship of having to travel long distances. Also, distance classrooms are typically equipped with the latest in educational technology that can enhance traditional lectures with the ultimate in hands-on, video, and audio technology.

Potential Psychological Roadblocks to Distance Learning

As universities move inexorably toward distance learning, it is educationally important to ask: What student variables influence how accepting students are of this innovation? Are older students more resistant to this non-traditional learning format? What sort of student finds non-face-to-face contact more problematic? What personality types find adapting to distance learning and other forms of educational technology most disconcerting? The authors reviewed ERIC, PSYINFO, and other relevant research databases. We found few studies regarding psychological/personality variables predictive of student acceptance of distance learning, despite the obvious relevance and importance of this research topic.

Most students have been socialized to expect of their education a teacher standing in front of them delivering a lecture. Distance technology represents a serious departure from this model. Students enrolled in a compressed

video class often are not physically in the same classroom as the instructor. In the case of these students, the non-verbal forms of communication often present between teacher and student, e.g., puzzled looks, looks of approval, physical proximity, may be impossible because of the physical separation. It is also a major challenge for the teacher to monitor what is going on in the classroom at the remote site, given the competing tasks of lecturing, coordinating the technology, and monitoring the students in front of her/him. These considerations, which may occur to students either contemplating or currently experiencing distance technology, must be explored to determine the positives and negatives associated with distance learning.

Current Study

Design/Subject Pool

In this research, students drawn from two universities, were compared. These students contrasted not only in geographic location but more importantly in exposure to distance learning. The students from Louisiana Tech were undergraduates who had never been enrolled in a distance learning classroom. This university is beginning to adopt such classrooms. The other pool was of graduate students enrolled at the Rensselaer Polytechnic Institute (New York). These students (only graduate students are taught via distance learning at this institution) were enrolled in a distance learning course at the time data were collected. We believed it important to compare students who were currently experiencing distance learning with those not yet involved. Thus, the design primarily involved a comparison of two groups, each involved at a different level of exposure to distance learning. Fifty-four Louisiana Tech students and twenty-three RPI students were use as participants in this study. Participation was completely voluntary and students were free to withdrawn from the study at any time.

Technology Survey

The authors constructed a 26-item survey designed to assess student attitudes about distance learning and other forms of educational technology (*Technology Attitude Survey*). The scale consists of 26 items that students either agree or disagree with using a 5 point Likert format scale. In each case, 5 means strongly agree, 1 strongly disagree. The scale has 2 subscales. Fifteen of the items were pro-educational technology statements designed to elicit positive attitudes toward distance and other forms of learning. One such item is: "I like to watch educational videos." This summative 15-item subscale is called PRODIS. Higher scores on this subscale correspond to more positive attitudes toward distance and other forms of technology. The other 11 statements elicited reasons for wanting to avoid exposure to educational technology. One such item is: "I need an instructor present to learn course material." This summative 11-item subscale is called NEGDIS.

Hardiness Scale.

The Hardiness Scale indexes a personality variable designed to gauge how well individuals can bounce back from stressors of different types. We included this measure because, arguably, as a departure from the traditional classroom, those who are hardier and more resilient should be more amenable to distance technology. This reliable and valid measure has 3 subscales: Commitment gauges how strongly the individual experiences the imputed meaning of self, others, and work; Control measure indicates her/his sense of autonomy and influence on one's future; and challenge refers to zest for life, and opportunities for growth and development.

Reactance Scale.

The Hong Psychological Reactance Scale (Hong, 1996) is a 14-item scale that measures the motivational state that is produced when freedom is threatened with elimination or actually eliminated. The reactance scale can be broken into 4 subscales. Of the subscales, we were only interested a priori with the Restricted Emotions score. This scale, also known as the Emotional Response Toward Restricted Choice, refers to an individual's emotional reaction toward the threatened loss of freedom or choice. The other subscales were deemed inconsequential for our research purposes.

Additional Measures

We also added a few additional questions. Participants were asked to rate on a six point scales how willing they would be to be involved in or have another (whatever was appropriate) distance learning course. Demographic information was also elicited. For instance, they were asked their age, number of distance learning courses taken, gender, etc.

Procedure

Students were assessed at the convenience of the college instructor. The materials were assembled in booklet form on standard 8.5" x 11" pages. All measures, along with our technology survey, were given to participants blind to our hypotheses. Booklets were adminstered to the group as a whole.

Results

Examination of the sample revealed that the sample was composed of 33 males and 44 females. In terms of ethnicity, the sample was predominantly caucasian, with a mean age of 23.6 years and a standard deviation of 9.9. No significant differences were found due to ethnicity or gender on any of the important variables in this study.

Comparison of the two university groups revealed that both groups were equal in their level of willingness to take a course via distance learning. However, it should be noted that the level of willingness found in both groups would be described as lukewarm. Indicating that students were not overly enthusiastic about the prospect of taking a distance learning course. Additionally, experience with taking a distance education course appears to have no impact on the level of willingness to take another distance learning course in the future.

Correlational analyses were by university, Louisiana Tech or RPI. Because the two samples involved two distinct populations, this was the most appropriate approach. Even though both samples included a broad range of ages, no correlations were observed between age and positive or negative attitudes about technology. This finding was somewhat surprising. We expected younger students who have been exposed to more technology to have more positive attitudes toward technology and its uses.

A comparison between the universities was conducted for the questions of the technology survey. Overall, no differences were found between the two university groups. Again, this would suggest that experience with distance learning has no impact on students attitudes toward distance learning and its technological uses. Certain test items of the technology survey produced strong responses for both university groups. Students strongly agreed with the following general test items: 1) regular use of computers; 2) technology is good for society and people; 3) use of technology to enhance learning; and 4) would take a distance learning course, if was only way to take the course.

Examination of personality characteristics that impacted students attitudes towards technology and distance learning revealed a couple of interesting findings. A negative correlation of .36 was found between positive attitudes toward technology subscale and the emotional responses to restricted choices subscale of the psychological reactance measure. This suggests that students who are less threatened by a potential loss of freedom or choice tend to have more positive attitudes towards distance education. Additionally, a significant positive correlation ($r = .42$) was observed between the positive attitudes toward distance education subscale and the control subscale of the hardiness scale. This suggests that students who have a greater sense of autonomy and feel that they can impact the future have a more positive attitude toward distance education and technology.

Conclusions

The results taken together suggest the following. Students generally are not overly positive in their attitudes toward distance education and their willingness to take a distance education course in the future. They are, however, decidedly positive about educational technology in general to enhance learning and society as a whole. It was remarkable how similar students' responses were at the two universities being compared, even though students at one university had already participated in a distance education course.

The personality data reveal that certain personality characteristics lead individuals to be more receptive and have more positive attitudes toward distance learning and educational technology. They are individuals who are less likely to see any change or innovation as a perceived loss of control. They have a greater sense of autonomy and perceive the future as somewhat controllable. In short, individuals who have a "take charge, can do" attitude are not intimidated by non-traditional teaching formats such as distance learning. Educators should bear in mind, however, that such attitudes can be inculcated in students through positive attitudes on the part of the instructor. Clearly, although tentative, the results of this study indicate that students' attitudes are not overly positive toward distance education and it may be that individuals differences of students need to be taken into account when designing and offering course through distance education. Further research is clearly warranted in this area to help understand the relationship between personality characteristics, attitudes and willingness to participate in distance education.

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Collaborative Tools for Changing the Way We Work

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Students from early childhood through graduate school have come to expect that they will work alone, write alone, complete projects alone, and be tested alone. Traditionally, in educational settings there has been competition for what is perceived as a limited resource, good grades. This paradigm, which has dominated academia for ages, ignores the findings of hundreds of studies on cooperative learning. "More is known about the efficacy of cooperative learning than about lecturing, the fifty-minute class period, the use of instructional technology, or almost any other aspect of education" (Smith, 1996). Even so, many educators do not make use of cooperative learning strategies because they lack a complete understanding of the processes involved in collaboration. This presentation demonstrated how tools such as the telephone, e-mail, and document sharing can be used to increase creativity, productivity, and foster cooperation within small groups or large organizations in both educational and non-academic settings.

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Web-Based Instruction Design: Basic Considerations for Pre-Service and In-Services Teachers Training

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Abstract: Without exception, effective web-based instruction begins with careful planning and a focused understanding of course requirements and student needs. Appropriate supporting technology can only be selected when these elements are understood in detail. There is no mystery to the effective web-based instruction development. However, effective web-based instruction do es not happen spontaneously; they evolve through the hard work and dedicated efforts of many individuals and organizations. That means well-developed design strategy is very important and detail guidelines are critical, these are the major focus of this paper. In fact, successful web-base instruction designs rely on the consistent and integrated efforts of students, faculty, facilitators, support staff, and administrators.

Change is a constant of the 20th century, and higher education has felt its impact as it approaches the millennium. The rising intensity of a new wave of technology, combined with the pairing of education and economic success, affects higher education institutions and other organizations. Consequently, concepts of lifelong, individualized or personalized learning and time and space free learning emerge from traditional campus settings. As we advance into this information age, we are facing the challenge for pre-service and in-service teachers training. The emerging of technology and concepts of learning made educators rethink the ways of delivery of teaching and learning in the teacher education. Claims have been made that the Web-based instruction can free teaching and learning from the physical boundaries of classrooms and the time restraints of class schedules (Owston, 1997). People believe that Web-based instruction or distance learning, with a history of serving remote learners, is emerging as part of mainstream education and training efforts to provide flexibility of time, space, and selection to learners. However, given the new technology does not mean the web-based instruction is done. How to design a effective online course and how to implement it in teachers education is a major task for us. Web-based instruction design strategy for pre-services and in-services teachers depends on the combination of technology and pedagogy and the guidelines relate to the strategy development.

Characteristics of web-based instruction

Much of what happens in the traditional classroom was influenced heavily by the behaviorist movement, which dominated American psychology about 1920 to 1970. Skinner (1938, 1953) believed that psychology was essentially about behavior, and that behavior was largely determined by its outcomes. Based on this pedagogy, computer-based learning materials were created and hundreds of studies were conducted to assess their effectiveness. According to Kulik (1996) and his associates, students using computers learned significantly more in considerably less time than students without computers. Cognitive

psychology portrays learners as active processors of information, although Skinnerian methods have been effective in training. Piaget (1969) felt that students learn better when they can invent knowledge through inquiry and experimentation instead of memorizing facts presented in a teacher-dominated classroom. Teachers must help the students learn how to develop strategies for learning, must do more than modify behavior.

Since there is only one teacher for many students, it is physically impossible for a teacher to support this kind of environment for each student in a traditional classroom. The web-based instruction helps by providing students with an interconnected world of knowledge to explore. Screen-capture and downloading enable students to collect what they discover and construct a framework for organizing and understanding. Since the learner is portrayed as an active processor who explores, discovers, reflects, and constructs knowledge, the trend to teach from this perspective is known as the constructivist movement in education (Hofstetter, 1997). Web-based instruction provides an environment for teaching and learning from a constructiveist perspective over www. The characteristics of web-based instruction include:

1. Physical distance between instructor and learner. The web-based instruction is often given other names—distance teaching, distance education, distributed education, learning at a distance. All of these names refer to some form of instruction in which instructor and learner are physically separated from one another. This physical separation is one of the principal—and defining—characteristics of web-base instruction.

2. Independent study or study groups. Web-based instruction may be set up to have learners participate either individually or in groups—or both.

3. Effectiveness and cost less. Whatever you call it, and whatever form it takes, distance learning can be an effective and economical strategy for reaching widely dispersed learners, because the workforce is widely dispersed. The dispersed workforce makes it expensive.in time and money for instructors to travel to the learners.

4. Flexible instruction/learning schedule. Web-based instruction can be designed to allow the instruction to fit students' schedules. Students are no longer locked into a fixed learning time. They can read printed text, watch a video, or work on computer-based instruction and still meet their regular responsibilities.

5. Self-paced learning opportunities. Web-based instruction can be designed to allow learners to progress at their own rates; they can skip over what they already know or repeat parts they have difficulty with.

6. With massive learners. When the primary purpose is to provide information, web-based instruction can be used to provide the same information simultaneously to a nationwide audience.

Experience has helped us understand better the features of a Web-based course environment and the tools that can enhance teaching and learning. Although the Web for teaching and learning remains in its infancy, we do have an exciting and potentially revolutionary beginning.

Strategies of Web-base instruction design

It is always a challenge to remain focused on teaching and learning issues and not the technology. Technology is an enabler and it only supports learning. It is important not to lose sight of teaching goals as one goes about mastering the technology. The best advice regarding to pedagogy is to take time to explore, exploit and experiment with integrating the unique features of the Web into your teaching environment. Think beyond traditional classroom paradigms as one begins creating on-line course materials, and consider incorporating a few of the following Web-based learning paradigms.

1. Personalized learning environment. The Web lends itself to student-centered learning. The hypertextual organization allows materials at different levels of detail or difficulty to be made available to students without imposing a pre-determined path for them to follow. Students can create individually tailored paths to master the desired goals, moving at their own speed and retrieving additional information as needed. Tracing mechanisms can assist developers/teachers in learning what kinds of links that students use most often.

2. Performance based education. This design strategy emphasizes developing course outcomes that challenge a future teacher to demonstrate a measurable understanding of the course objectives. These outcomes are to provide an opportunity with the application of the knowledge and skills to real-life situations. This success breeds success, web-based instructional design and instructors control the conditions of success, and all students can learn and succeed.

3. Collaborative learning. Researches have shown that students benefit immeasurably from the environments that encourage shared learning. The Web presents an especially good environment for asynchronous collaboration in which students work together but not necessarily at the same time. Teachers of English composition, for example, have found that a networked writing environment provides an effective means to get students to write more and to learn from one another. Faculties in many disciplines have found that Web-based discussion forums can lead to fuller participation in class discussion by all students.

4. Basic psychological needs. In the design of any educational setting, in a classroom or on the web, we must take into account of the basic needs of every learner in order to build as positive and productive an environment for learning as possible. The basic psychological needs include two sides. One is that others recognize one as saying ordering things of importance, and the other is that others for whom one cares are willing to give and accept from him or her affection, care, and friendship. We can act and think without restriction by others as long as we do not significantly interfere with their access to the same freedom. We must engage in a behavior that is enjoyable and in which there is good feeling on the part of all involved.

5. Multimedia presentation. The Web is able to provide an increasingly rich variety of media through which we can present learning materials, including exciting new options like streaming audio and video animations. For example, it is now possible through browser plug-ins, such as Shockwave, to present effective simulations of science experiments. For learning languages, audio and video can supply an electronic immersion in the target culture using authentic materials by native speakers. Using a variety of media (text, graphics, audio, and video) to present the materials may also accommodate individual learning styles, and provide approaches for both visual and auditory learners.

6. Reinforcement of learning. Organizing materials in a hypertext format allows the integration into a variety of contexts. Interactive testing through HTML forms or client-side Java application enables self-paced learning and regular reviewing of covered materials. Weighted values can be assigned to items in order to generate automatic recommendations for remedial work, or to create more advanced learning.

7. Updated information. Not only do textbooks by necessity use a one-size-fits-all approach to learning, they also in the fast moving world tend to become out of date soon after publication. Web materials allow for easy updating, although it is of course the content providers' responsibility to do so. In many fields, the access to recent research over the Web becomes a reality through discussion groups, electronic journals and on-line conference presentations. We are not yet at the point at which a study in any field can rely solely on the Web as a research source, but the Web is becoming indispensable in ensuring the most recent disciplinary discussions.

8. Global resources. One of the marvels of the Web has always been the ease and transparency with which local and global resources are combined. Instructors can put their own materials on line and link them to the resources throughout the world. From the students perspectives, the resources are just at a click away. This convenience provides students with the possibility of consulting disciplinary experts on-line as easily as students read professors' course syllabus.

The above strategy consideration is based on that learning is a lifelong process, is important to successful participation in the cultural, civic, and economic life of a democratic society. Lifelong learning involves the development of a range of learning skills that should be explicit outcomes of learning activities. The diversity of learners, learning needs, learning contexts, and modes of learning must be recognized if the learners are to achieve their goals. Because learning is social and sensitive to the learning context, learning experiences should support interaction and the development of learning communities, whether social, public, or professional. The development of a learning society may require significant change in the roles, responsibilities, and activities of provider organizations and personnel as well as of the learners themselves.

Guidelines of Web-based instruction design

With the growth of technology such as World Wide Web and its ease of use, the Internet has become an attractive option for alternative course delivery. This is really the good option for teacher training program, especially for in-service training. Instructional design focuses on facilitating an individual' learning while taking into consideration the specific context of the learning environment (Gagne, Briggs, & Wager, 1988). Although students taking a course via the Web will not have an equivalent experience to those students who receive traditional classroom instruction, it is expected that they leave the course with the same knowledge base. When developing Web-based instruction, it is critical

to have a well-designed format in order to obtain the maximum impact on the participating students. A guideline for Web-based instruction design is critical in informing the development, delivery, and assessment of the program. The following are suggested guidelines.

1. Web-based instruction design should include a clear statement of demonstrable learning outcomes consistent with the objectives of the program. We should shape the program development process to achieve the intended learning experience, to inform the choice of educational media and delivery methods, and to serve as a focus for assessment of learner progress. We should establish instructional goals/objectives, based on the nature of the problem as well as student needs and characteristics. Goals are broad statements of instructional intent, while objectives are specific steps leading to goal attainment. We should also review and update the web-based instruction on a regular basis to assure their timeliness and appropriateness to the learner.

2. Web-based instruction should establish who the audience is, what training they need, whether there are any constraints on the audience in delivering or receiving the training. We need to analyze our audiences to obtain a better understanding about the learners and learners' learning needs, and consider their ages, cultural backgrounds, past experiences, interests and educational levels. We need to assess learners' familiarity with the various instructional methods and delivery systems to determine how they will apply the knowledge gained in the course. We also need to notice whether the class should consist of a broad mix of students or discrete subgroups with different characteristics (e.g. urban/rural, undergraduate/graduate). When possible, an instructor should visit distant sites and interview prospective students, both individually and in small groups. This personalized attention will also show students that the instructor is more than an anonymous presence linked by electronic technology.

3. Web-based instruction activities should be designed to fit the unique multidimensional context of each learning situation. We should take these into account: the nature of the subject matter, the intended learning objectives and outcomes, background, needs, resources, and goals of the learner. We should consider learner's control over the time, place, and learning pace. We should also insist on a collaborative design team structure required for optimal program delivery, and for appropriate instructional technologies and methods.

4. Web-based instruction should be able to build up learners' confidence with technology. Student participation in web delivered courses relies on three interdependent technologies: the learner's computer equipment, Internet access and the usability of the hyperlinked WWW learning environment. We should provide learners with enough technical support or help to gain confidence with the web interface itself and to interact actively with online learning activities.

5. Web-based instruction should be able to provide learners with clear learning activities. Learning activities should be informatively listed and clearly indicated on a single page. From this page, students can link to separate lectures, case studies, and discussion pages. This list serves to anchor the activities and help faculty work no matter what time of day when students logged on. Students will be able to understand clearly that there is deadline for submitting the work.

6. Web-based instruction should consist of build-in collaboration and facilitated team projects. We should encourage the collaboration with other educational institutions, government agencies, and industry of developing Web-based instruction. We should leverage each organization's unique capabilities, exploit appropriate models for evaluation and develop its accreditation. Positive interdependence underlies the successful application of collaborative learning principles.

7. Web-based instruction should consist of basic course elements for instruction faculty. First element is online Syllabus. An online course syllabus provides the instructor with a way to change course materials easily, and provide the students with a complete and up-to-date picture of the course requirements. Hypertext links to sample relevant disciplinary web sites may be helpful in giving students (and prospective students) a sense of the disciplinary context for the course. The second element is assignment. Web page listing homework assignment, upcoming events and exams can be more interactive than the familiar print version. If some homework assignments, for example, are based on on-line materials, they can be directly linked to the class schedule. The third element is announcement. To be effective instruction, some announcements need to be delivered on the web. Students should be informed that how and when a new announcement will be posted. Alert boxes or running footers or a blinking link added to a page can remind students of new announcements. The fourth element is personal Home Pages. Personal home pages can be used to foster the sense that the class is not just a collection of isolated individuals but a community of learners. Students can benefit from interacting with one another. Home pages encourage students to learn from each other so as to encourage the contact and mutual curiosity. The

fifth element is interactivity. Adding discussion forums and chat sessions to an on-line course is a common way to cast an interactive component to a web-based course. There are many implementations of bulletin board and chat session software available to choose from, but we recommend selecting one that allows the attachments (as an easy way of sharing files). Another method to create interactivity is, of course, through e-mail. It is a good practice to have an online list of all registered students with their e-mail addresses provided. The sixth element is testing. Online drill and practice or testing can be used to reinforce the learning even if not used as part of a grade. Reading comprehension questions, for example, in short answer or multiple choice formats can provide students with self-assessment of their understanding of the text. The seventh element is course management. Software should be available to add/delete students from a course, assign students ids and passwords, create/edit homepages, and manage the interactive discussion groups (e.g., delete old or unnecessary entrees, and archive topics). Final element is content. Perhaps the most difficult part of developing a web-based course is creating the online content. One can begin by translating his or her basic lecture materials to the web-based instruction format, and integrate media such as sound, images and even video into instruction. Presenters recommend experimenting with incorporating some of the new web-based learning paradigms described above.

Good web-based instruction design practices are fundamentally identical to good traditional teaching practices. However, those effective instruction strategies and instruction design guidelines may be generally universal across different environments and populations. Because web-based instruction and its technologies require extensive planning and preparation, successful web-base instruction designs rely on the consistent and integrated efforts of students, faculty, facilitators, support staff, and administrators.

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DIVERSITY

Access and Utilization of Computer Technology by Minority University Students

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Abstract

Universities assume that entering students possess computer skills and literacy. Universities then utilize these assumed skills by offering computer-based instruction, requiring research using the World Wide Web, offering online courses, and integrating computer utilization into many courses. Universities seldom stop to determine if required competencies exist uniformly across all students. Literature has shown that computer access and integration of computers into curricula have been significantly lower in student populations from ethnic minorities in K through 12 public schools. This study looks at access and utilization issues of students at an urban university across students of many different ethnicities to determine if discrepancies persist at the university level.

Introduction

As budgets shrink, student demographics change, and the demand for accountability increases, higher education confronts the urgent need for transformation. Among the institutional responses to our changing social and economic milieu is a heightened commitment to the integration of interactive technology, as both a mode of instructional delivery and as a means for student learning and performance. Our institutions have found that they must adopt "information technology to stay in business" (Barone, 1996, p. 28). In fact, institutions that do not or can not transform themselves to meet the needs of students in our technology-oriented society will not survive (Stallings, 1997).

As the technological transformation of higher education continues, the student body becomes increasingly heterogeneous. Between 1984 and 1995, the presence of ethnic, racial and linguistic minority students in higher education rose by 67.7 percent (American Council on Education, 1997). By fall 1995, 25 percent of all college students were African American, Latino, or American Indian (NCES, 1998a).

With the demographic heterogeneity on the university campus comes a diversity of background experiences and knowledge. Many traditionally underrepresented groups arrive at the university with rich personal and professional experiences and knowledge, but those experiences and knowledge may not include the computer and interactive technology. As Kruper (1996) notes, many students are

"technophobic" and lack the background and skills to fulfill computer-related assignments. Moreover, access to technology is not only a matter of access to hardware and software, but also to the use, training, experiences, and varied applications of technology.

Though home ownership computers increased by 11.4 percent nationally, reaching a new high of 40.7 percent of American households (NY Law School, 1998), the computer is still not a ubiquitous presence. National statistics illustrate the differences in computer access and experiences among students. Computer ownership in America rose 51.9 percent between 1994 and 1997; during that same period, modem ownership increased by 139 percent and email access grew 397 percent (Meeks, 1998). Computer access, however, differs across racial, ethnic, gender, economic and geographic divides. White households (40.8 percent) are more than twice as likely to own a computer than Black (19.3 percent) or Latino (19.4 percent) households (Meeks, 1998).

The increased commitment to technology in higher education and our society's growing dependence upon technology for personal, social and economic development have a tremendous potential for disenfranchising and disadvantaging these technologically-poor segments of society. If our universities and colleges hope to furnish equitable access to higher learning, then they must concern themselves with equitable access to information technology.

Research Questions

The researchers are professors at an urban, upper division institution in the western United States. The majority of the undergraduate students are transfers from the community-college system. This campus has a growing population of nontraditional, minority students and an emphasis on computer technology. The researchers are concerned about minority student academic success in an environment where computer technology is playing a growing role in academic instruction and learning. Given the inequality in public schools between upper-middleclass districts and lower socio-economic districts (which are also de facto segregated), they are particularly concerned about minority student preparation in computer technology and issues of computer ownership. The following research questions form the basis for this study:

1. Do nontraditional, low socio-economic and traditionally underrepresented college students in higher education have the same access to computers and information technology as traditional majority students?

2. Do nontraditional, low socio-economic and traditionally underrepresented college students in higher education have the same computer training and information technology background as traditional majority students?

3. Do nontraditional, low socio-economic and traditionally underrepresented college students in higher education use the same computer applications as traditional majority students?

4. What factors are associated with access and frequent use of information technology?

The Study

A stratified random sample of students was drawn from the active student population at an urban, upper-division, western university in spring of 1998. The sample was stratified by ethnicity and by college. Specific classes were randomly selected to be a part of the sample based on returning a sufficient number of students who met ethnic and major stratification criteria. The total sample size was 621 subjects. This represents more than 10% of the entire student population. After eliminating duplicate classes, the final sample size was 578. Both graduate and undergraduate students were included in the sample. The response rate was 64.2% (371 respondents).

A profile of the respondents

The majority of the respondents were older than 25 years of age (55.7%), female (62.5%), and Euro-American (64.4%). The minority ethnic representation of the respondents was African-American (3%), Native American (2.2%), Asian American (5.7%), and Hispanic American (10.5%) for a total of 77 (20.8%) minority respondents with another 37 or 10.5% who either did not choose an ethnic category or marked other. These numbers closely reflect the total student population at ASU West (2.5% African-American, 77.3% European-American, 1.6% Native American, 3.7% Asian-American, 11.8% Hispanic American, Other 3.1% and 65.6% female).

The students were asked to identify their major by the College in which their major resides. Fifty-seven (16%) respondents listed their major within the College of Arts and Sciences, one hundred six (31%) as business (School of Management - SOM), one hundred and twenty-five (36%) as College of Education, and fifty-nine (17%) as College of Human Services.

The majority of the respondents (70.6%) were enrolled in 10 or more credit hours per semester and worked over thirty hours per week (69.6%). It is interesting to note that the minority undergraduate students worked an average of 4 hours per week more than the majority undergraduate students. Although most claim English as their first language, 12.4% do not. Many are the first persons in their family to attend college (29.6%). Most rely on themselves or some means of financial aid to support their education (70.8%).

Findings

Computer Skills and Training

All but two of the subjects (both of whom are minority students) have used computers. Majority students feel more positive about their knowledge of computers (mean of 2.33 where 1 is excellent) than the minority students (mean of 2.46) ($p=.042$).

The first computer experience of majority students occurs at an earlier age than minority students and is more likely to occur at home rather than in public education settings. More than half of the majority students had their first experience with computers either at home or prior to attending community college (53.2%) compared with less than one third of the minority students (32.5%).

The respondents were asked what type of training they had received. They were allowed to mark more than one response. The responses included: 1) elementary school 57, 2) middle school 70, 3) high school 123, 4) community college 203, 5) university 144, 6) self-taught 190, 7) private computer school 17, 8) correspondence course 11, 9) computer store 5, 10) friend's home 35, 11) at home 126, and 12) through work 162.

Respondents reported taking 3.02 (mean) courses about computers, and 1.6 (mean) courses about interactive multimedia. Only 25 (6.7%) of the respondents have taken courses through Technopolis. Most of those who did not take courses through Technopolis (computer access center) gave lack of knowledge of courses and their existence as the reason for not taking courses (159 or 42.8%).

When asked if they have taken a course over the Internet, 36 or 9.7% responded yes. Most of the respondents have used the Internet at some point (343 or 92.4%). The most common means for learning how to use the Internet was by exploration by oneself (231 or 62.2%)

Computer Access - Hardware

Most of the majority students own a computer (81.6%). This is higher than the national average of 40.7% of households in US (NY Law School, 1998). Although 66.2% of the minority students own

computers (also higher than the national average), this number is significantly lower than the majority ownership rate (p=.00037). The total sample consists of both graduate and undergraduate students. When the graduate students are removed, the difference in ownership is still statistically significant (p=.00077).

Sixty-four (18%) of the respondents did not own a computer. Forty-four percent of these respondents were minority students. Seventy-five percent of students who did not own computers used those available on campus. These students used university computers an average of 6 ½ hours a week. Minority undergraduate students use computers at the university more hours per week (mean of 4.57 hours) than do majority undergraduate students (mean of 3.61 hours) (p=.044).

When asked which of the following campus computer facilities they have used, they reported the following: electronic classrooms 124 (33.4%), library computer classroom 52 (14.0%), library workstations 141 (38.0%), library multimedia computers 57 (14.4%), statistical laboratory14 (3.7%), and tutorial lab 9 (2.43).

Computer Access – Software

Two hundred and ninety-nine (82%) of the students surveyed use the computer access center. Students are generally satisfied with the support staff. Eighty-nine percent of the students indicated receiving help with computer programs always or sometimes. Only three percent of the students indicated that they did not receive assistance. The most frequently used software packages are Microsoft Word® (81%), Netscape® (73%), Microsoft Excel® (39%), Microsoft Powerpoint® (35%) and Pine email (29%).

Those who use the computer resources at the library also reported satisfaction with library support staff. Fifty-nine percent of the students indicated receiving help with computer programs from the library staff always or sometimes. Only 2.1 indicated that they did not receive assistance.

The software resources most frequently used in library include: the online catalog (233 or 62.8%), ERIC database (133 or 35.8%), ABI/Inform (82 or 22.1%), and database from other libraries (80 or 21.6%)

Computer Access - Internet/email

Of those who own computers, 232 or 62.5% have access to email and 224 or 60.4% have access to the Internet. One hundred fifty-six (42%) use email and one hundred thirty-three (35.8%) use the Internet on a daily basis. There is no significant difference of email and internet usage between minority and majority students who own computers.

Current Computer Use

Two hundred ninety-seven or eighty percent of all the respondents use the computer on a daily basis and most (259) would use it more if they had more time. Most of these are Microsoft Windows® users (311 or 84%) and use the Microsoft Office® suite of software on a regular basis.

Classroom Computer Use

Most of the respondents reported that their college courses required them to use the computer "a lot" (228 or 61.4%) although 154 (41.5%) reported that they don't know how many computer courses their college major requires.

About one third (129 or 34.7%) wished that they were required to take more computer courses in their major course of study. It is interesting to note than that most subjects reported that their professors do not use computers in class (191 or 51.5%) while 196 or 52.8% believe that their professors use computers to manage class grades, lessons, handouts, and presentations.

Most respondents did not feel that they were well prepared to use technology (mean of 2.93 where 1 was strongly agree). Minority respondents feel less prepared (3.04) than majority respondents (2.87)

(p=.028). While they don't feel well prepared now, they seem to have confidence that they will be able to use technology in their future careers (311 or 83.8%).

Computer Perspectives

The respondents were asked a series of questions to find out how they view the issue of computer access both on and off campus and how to solve computer access issues. They believe that everyone attending ASU West has the "same opportunities to use technology" (306 or 82.3% marked highly agree or agree). It appears that most respondents interpreted this question as relating to usage while actually on the ASU West campus although the question is rather vague in this regard. An even greater majority support student loans to help buy computers (318 or 85.7%) and believe scholarships should provide money to buy or rent computers for home use (316 or 85.1%). Fewer respondents support "loaner" computers to be borrowed from the university on a semester by semester basis (252 or 70%).

Conclusions

1. The first computer experience of majority students occurs at an earlier age than minority students and is more likely to occur at home rather than in public education settings.
2. Computer ownership is unequal. Minority students own computers at a lesser rate than do majority students. This difference holds true even when the graduate students are removed from the sample.
3. The computer access center and other computer resources at the university are more likely to be used by minorities. These students are also more likely to be satisfied with the level of help they receive while using university resources.
4. Students use the same applications regardless of ethnicity. Minority and majority students who own computers are as likely to have access to the Internet and email.
5. All students, regardless of ethnicity do not feel well prepared in the use of technology. They also do not see their professors using technology in the classroom and some wish that they were required to use computers more in their major courses.

Recommendations

As we increase the number of asynchronous courses, the amount of computer- and internet-supported coursework, and the use of email for student-to-student and faculty-student communication, we need to consider the impact of these computer-related changes on individual students and faculty. The findings of this study suggest some areas that need to be addressed if universities are to implement technology integration and applications that are fair and equitable for all students.

This study reveals that minorities are less likely to own computers, are apt to have their first experience with a computer later in their lives, and express less confidence in their knowledge of computers than majority students. Clearly, then, as we move toward greater use of technology for instruction and coursework, we need to take proactive measures to ensure that some students are not unfairly disadvantaged. Based on our findings, we recommend several changes that will expand computer ownership, training, support, and modeling of professional use of computers.

1. **Computer ownership**- although most students in our survey own a computer, the largest proportion of those who do not own a computer are minority students and the most frequent reason given for non-ownership was financial. Thus to increase home computer ownership by these students, universities must find ways to provide computers for students who cannot afford them.
2. **Computer training** - since minority students and other nontraditional students expressed less confidence in their computer knowledge and most had their first encounter with computers at the community college or university, there is an apparent need for further

computer training and opportunities to use computers. Therefore, campus-wide minimal technology competencies should be established. These competencies should then be assessed both upon entry and just prior to exit. Appropriate training for individual students could then be determined on the basis of identified need.

3. **Computer Support**- expand support services to students. Also the hours that the computer access center is available must be expanded to meet student needs.
4. **Modeling of computer use** - the presence of technology in higher education does not guarantee quality in scholarship, teaching or learning. As with other human tools, its effectiveness relies upon the skill and knowledge of the user and upon its application to appropriate tasks. If we want our students to become computer competent and to feel well prepared to use technology, then they must see how computers can be used in their chosen profession and observe many of its applications in use. By implication, then, faculty need to feel confident in their own computer skills, understand its possibilities as an educational tool, and find value in its use. Yet, respondents to our survey overwhelmingly indicated that they had not seen their instructors making use of computers in class.

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Practicing Stereotypes: Exploring Gender Stereotypes Online

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Abstract:
Eliminating gender imbalances online should be possible with the ability to mask identity and move in worlds anonymously. If almost half of Internet participants are women, what is happening in the social realm of online space in relation to these numbers? This paper shows how a course called "Gender and Technology" introduced students to online chat and from there evolved into a larger study involving online avatar representation, chat, and gender. Language, time of day, and avatar representation are examined for their significance in creating gender stereotypes.

Introduction

The forms of communication and access afforded by the Internet have helped define cultural assumptions and realities in relationship to technology. The intersection of these forms has implications in most corners of historical, scientific, and cultural study. Gender study in conjunction with practices relating to technology offers an important site to study the impact of the union of technology and culture. An abundance of research on gender and technology has focused on the imbalance in education at the elementary level. The declining percentages of women in technology reflect the documented gender bias in the design and delivery of technological knowledge (Swanson, 1997; Mangione, 1995). Higher education, while studied less frequently, offers a similar environment. Despite a widely publicized national need for information technology, knowledge media, and instructional technology professionals (Wee, 1998; Furger, 1998), technology courses and programs do not attract a large percentage of women. The number of women entering University-level Computer Science programs in North America has declined steadily over the past two decades (Department of Education's National Center for Statistics, Computing Research Association's Taulbee Survey). To rectify the inequities, schools such as the University of Massachusetts are offering courses online. Representatives of the school argue that Internet-based courses allow teachers and students to interact openly and equitably, without bias based on race, age, or gender (Colker, 1995)

Gender stereotypes about technology strongly affect adolescent girls and women. (Brunner, 1994; Furger, 1998) Many females hesitate to disclose much personal information online in order to avoid damaging assumptions such as condescending presumptions about the knowledge level of female users (Furger, 1998, p. 72). While most female users value the Internet for its usefulness in thwarting stereotypes about looks, clothes, ethnicity, and so on, (Furger, 1998, p. 71) overall they are extremely cautious users. "Many of the chat rooms—even those ostensibly set up for children and young adults to talk about hobbies or books or movies—have turned into virtual pick-up scenes. Newcomers are often asked to give their "stats," and with many older teens and adults participating in the chats the conversation can quickly take a vulgar turn" (Furger, 1998, p. 74). This type of incident happens outside of notorious chat rooms, as well. Stephanie Brail (1996, p. 146) tells her story as a victim of online harassment. While participating in the Usenet newsgroup *alt.zines*, Brail became the subject of hundreds of harassing, threatening emails sent by an online stalker. She claims that because of such incidents, she and many other female Internet users censor themselves when participating in "public" groups online (p. 147).

Eliminating gender imbalances online should be possible with the ability to mask identity and move in worlds anonymously; unfortunately, intimidation in cyberspace can translate to verbal intimidation (Sutton, 1996, p. 171). Susan Herring has found invariably in her studies on gender and computer use that online communication is male-oriented and dominated by the use of assertive language and confrontational

approaches (Sutton, 1996, p. 175). In addition, women's' technology skills lag behind the skills of their male counterparts (AAUW, 1998, p. 54). It comes as a surprise, then, that in 1997, the number of females using the Internet was almost parallel to the number of male users. Over 40% had used the Internet at home or in the office during the last 30 days, and 47% of women surveyed had access to the Internet through home or work (Dept. Office of Educational Research and Improvement, National Center for Education Statistics, 1997). Online spaces are cited by many women as a chance to speak openly and democratically, allowing underrepresented groups to have a voice (Gersch, 1998). Access, however, is different than usage time. In the Times-Mirror and SPPA surveys of 1997, men who use computers at home give weekly usage estimates that are 20 percent higher than female users (Robinson, Levin, and Hak, 1998). The Internet should serve as a tool of empowerment for women. If almost half of Internet participants are women, what is happening in the social realm of online space in relation to these numbers? Why is access so high a percentage, but hourly usage measured so much lower than men's usage? Does the "evening out" of the number of users also balance gender inequities in online interaction? Could this imbalance stem from differences in language usage online, time of day, or forms online avatar representation?

The Context

The Internet proved to be an effective tool to explore gender stereotypes, identity issues, and gender awareness during a course called Gender and Technology in the Department of Media Study, State University of New York at Buffalo. The course took a rather untraditional approach to gender study in relationship to technology. While focusing on theory relating to gender issues, students actively engaged with films, advertisements, web sites, photographs, online art, and literature. Topics included: the role and recognition of female weavers in Imperial China, women's relationship to the industrial revolution, men's connection to the cyborg body, changing gender roles as technology infiltrated the home and office, and today's technological developments as they relate to gender, identity, and sexuality. At first many students were forcibly opposed to the word "feminism;" however, as the students had little positive experience with the concept behind the now somewhat negative classification. Towards the end of the course, students had developed sensitivity to gender issues through various media, open discussions, and real world experiences.

In order to develop those "real world" experiences of gender bias and discrimination, students were assigned to one of five online chat rooms. Surprisingly, 13 students (half of the class) had never experienced online chat or any other form of live Internet interaction. At a University of 26,000 undergraduates, well equipped with public computer facilities and wired dorms, this seemed unusual – especially given the publicity chat has received in computer magazines and in popular media. One session was spent exploring chat communication in depth. Taking the students to "The Palace" chat room (http://www.thepalace.com), the students donned gratis avatars (smiley face icons) and set about typing messages to strangers. The students and instructor discussed who might be in the room, what time of day might attract different users, and reasons for choosing avatar representation. Several chatters already in the room asked sex, age, and appearance questions; conversation was limited. The limited, staggered text interaction with other visitors almost encouraged users to leave. Although some private or "closed" sites may offer deeper interaction, these students were *newbies* trying to find meaning on the web together. Most students in the room were shocked (or snickering) about the amount of conversation in the rooms that focused on sex or "picking up" other avatars.

The Short Study: Student Run

Online graphic chat tools are wonderful venues to foster discussions about identity and stereotypes. The online environments offer the distance and anonymity for students to take the risk of expressing and defining themselves in a proactive manner. After the introduction to chat, 6 male graduate and undergraduate students implemented an introductory survey of chat room identity. Using a dialogue script, the group met at several different times and informally recorded how they were received in the rooms, including language used and appearance of the avatar chosen. The male user/participants in this preliminary study found that as female characters, their overall impression of "public" online experience was frustrating. According to post-project interviews, the men were spoken to, followed, and harassed three times the amount of their male avatar counterparts. One 22 year-old student noted, "If they could just get over the fact that I might be a woman or a man --that it just doesn't matter--we could actually have a conversation." Most of the student participants noted in participation surveys that the level of interaction

currently possible in online chat was superficial, slightly offensive, and ultimately boring. The male students who conducted their class project were surprised at the kinds of harassment they suffered online. The college-age participants' summaries led to a consensus: many public chat sites and virtual worlds have the feeling of the dorm room party that repeats itself nightly. They had been asked too many times, "Wanna Cyber?" and "sex/age/weight??" One participant stated that when he first discovered chat, he desired to grow from the experience of communicating with an international "community;" however, the six students surveyed before and after their short study all cited that they had lower expectations for future online interaction.

The Full Study

After the preliminary student study, a larger study involving online avatar representation, chat, and gender began. The smaller experiment had generated a good deal of interest and conversation about the role of the graphic icon and its relationship to the gender of online computer users. The goal of the larger study was to see if and how the reliance on a graphic as representation affects interaction.

Microsoft Comic Chat --a chat space that uses a comic strip look and feel for interaction—was used as the online setting. The background for the chat is graphically similar to a comic strip in that it uses square frames for each "scene" in the chat process (see Fig. 1 and 2.) Users choose from several dozen comic strip character graphics to serve as avatar representations. To communicate, users type to chat and the text appears in "talk balloons" protruding from character's mouths and extending over character's heads. Comic strips generated in Comic Chat can later be printed out or saved.

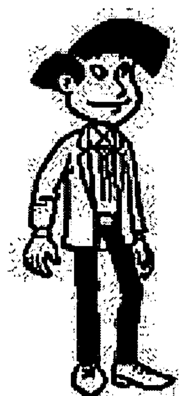

Figure 1. Male Avatar, Comic Chat

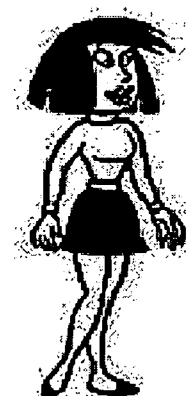

Figure 2. Female Avatar, Comic Chat

Using a script to enact repeatable, live dialogue, the two participants used either all-male or all-female avatar representations during one of six chat episodes. The avatars (Figures 1 and 2) were chosen because they were clear representation of male and female without overly sexualizing the characters. The participants' characters were named with gender-neutral titles (eg. Anyone). Rooms attended (from over 100 available) were chosen because of their gender-neutral titles; rooms using suggestive or sexual names were avoided. In addition, the room chosen had to be occupied with at least three public users. The average number of occupants was 8, with a peak at 11.Separated spatially during the study (different labs), they would arrive in particular Comic Chat domain at a specific time and proceed to greet each other and type out the script in a conversationally timed pace. The script detailed happenings at a party and allowed each member a similar number of lines—each character had approximately 25 - 30 lines of dialogue in the conversation. The script was filtered for gender-related pronouns and other descriptors in order to make no gender references in the text originating from the home base of the study. Of course, interaction with the public characters added slight variation to the dialogue. For example, dialogue had to be repeated at times to clarify a particular concept or sentence to a public user.

Six performances of the script were scheduled over two consecutive days: 2 the first day, one the second. Three chat areas were used, one each half-hour, in a sequence and in locations known only to the participants. Non-descript, non-suggestive rooms were chosen. Different times were chosen in order to offer the opportunity for different demographic groups to potentially react to the dialogue; after-work times were selected in order to avoid issues of censorship or self-monitoring at the workplace. The first day, the

dialogue was enacted at 11:00 p.m. and 12:00 a.m. The second day, the dialogue was enacted at 6:00 p.m. Each dialogue set took approximately 18 – 26 minutes to perform. The gender of the characters was changed each half-hour and a new room chosen for the dialogue.

Figure 3. Male Avatar from Research Group Meets Public User in Comic Chat "Room1"

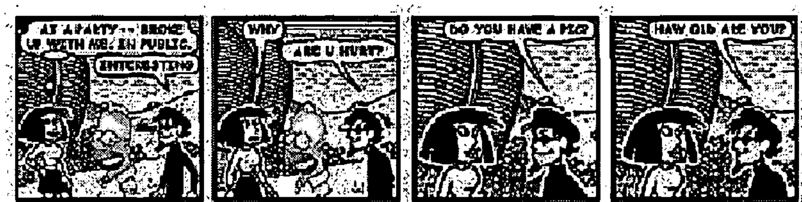

Figure 4. Female Avatar from Research Group Meets Public User in Comic Chat "Room1"

Findings

The chart below details several research issues mapped out in the avatar and gender study. First, the date and time of the performance are listed. From that list one can see which gender the test group appeared as in the chat world. The number of users in a room changed the kinds of interaction towards the test group. The number of "whispered," or person-to-person messages, were also measured, along with the number of questions the public users in the room directed towards one or more members of the test group. Finally, the group was asked to rate the number of potentially harassing comments directed at them during the course of interaction.

Date/Time	Avatar Gender For Study Participants	Number of Users In Room	Number of 'whisper' msgs sent	Number of questions directed at test subjects	Number of directed references to sex/gender	Number of directed, potentially harassing comments
Day 1						
11:00 p.m	Male	11	2	5	4	1
11:30 p.m	Female	6	8	13	11	6
12:00 a.m	Male	9	2	12	13	2
12:30 a.m.	Female	7	8	19	29	15
Day 2						
6:00 p.m.	Male	5	1	5	1	3
6:30	Female	11	0	9	7	3

Figure 5. Data gathered from online study of gender and avatar representation.

Finding 1. Language use varies according to avatar representation.
Two striking features of the experiment are the amount of questions directed at users utilizing female avatars, and the way in which language is used towards the avatars of different genders. Female avatars were the recipients of more questions by public chatters than were male avatars across the board, and additionally the interaction by the public to the test subjects tended to include references to sex/gender. In this study, the more "whisper" (private, person-contacting-person directly outside the public chat arena; also called direct sends or instant messages) messages sent, the more likely the comments made by the public user were judged to be potentially harassing to female avatars.

While extremely difficult to quantify, participants in the study also observed an overall attitude shift by public chatters in relation to their representation. They note that male avatars used "smooth-talk" to interact with the female avatars more than male avatars, and cited that male-avatar to male-avatar conversations were more blunt and direct. Comparing the examples of Figures 3 and 4, we can see that two profanities (blocked out for this paper) appear from public chatters while the participants were represented as male avatars.

Finding 2. Time of day can affect interaction response.
In this study, later chat times tended to include more sexually oriented chat that earlier time slots. Reasons postulated for this can be based on Brail's work, who notes that some chat rooms "are notorious for having a barlike atmosphere...should you enter a chat room using a woman's login name, you're likely to find yourself the target of a wanna fuck instant message" (p. 142).

Finding 3. Harassment was defined before the study in terms set forth by Brail (1996, p. 142): The frequency, persistency, and/or unwanted, threatening, or offensive communication from one user to another. As Brail notes, however, there is "a huge gap between legal definitions of harassment and what we describe as harassment in common parlance" (p. 142). For the study, the participants based their definition of harassment on the way they received the language directed at them. This is clearly a subjective area for the individuals involved, yet can be cursorily documented by the variance between differently-gendered avatars using the same dialogue script. The amount of harassing language directed at female participants is high in the documentation of this study. It is important to note, however, that male avatars were also harassed, though with less repetition. The comments cited as harassing were often threats of violence, but were not necessarily tied to sexual terms.

Conclusion

From this study, we can see that online interaction using gendered avatar representation is in fact consistently approached along gender-specific lines, and that often these approaches include specific targeting of users and forms of harassment. Both stereotypical treatment of female avatars and stereotypes about characters representing themselves as female through their iconographical presence are prevalent. Gender stereotypes within technological arenas such as the Internet exist through the continuation of non-internet practices. Sandy Stone suggests that until online identities are interpreted as "personae", outside the "pre-net assumptions about the nature of identity," we cannot reexamine stereotypes, nor can we think deeply about alternative forms of identity construction (1995, p. 81). Additionally, the reliance on the graphic as the site of representation brings with it a loaded message that can ultimately reinforce gender stereotypes. Online graphic chat tools are wonderful venues to foster discussions about identity and stereotypes. The online environments offer the distance and anonymity for students to take the risk of expressing and defining themselves in a proactive manner.

Oddly, while cyberspace allows users to create almost anything that can be imagined, we design societies and environments that mirror what already exist, rife with gender, racial, and other bias. According to an interview with the technology-driven performance artist Stellarc, "consider the fact that it's only through radically redesigning the body that we will end up having significantly different thoughts and philosophies"(Atzori and Wollford, 1997, p. 196). Stellarc notes, "I think our philosophies are fundamentally bounded by our physiology" (p. 196). If he is right, then why, do we not truly escape our bounds when in a virtual space? And if we do, why then, when we have the opportunity to redesign and rethink what the body really is, we do not?

Ultimately it is by questioning culturally formed identity, experience, and political standing that we can begin to disrupt our assumptions about ethnicity, class, and gender, and ultimately, our beliefs in absolute and fixed identities (Harding, 1991, p. 110). Unsettling these stereotypes should serve to offer all Internet users a chance to see and share multiple perspectives about gender bias. There are tremendous benefits to online interaction: building communities, learning via distance education, sharing advice around the globe, and access to a wealth of information resources make the web a great place to be. Studying online interaction styles can therefore reveal the general conceptual framework formulated by users in relation to gender and help postulate a method for change.

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Beyond the Learning Tool Paradigm: The Computer as a Medium in a Technology Enhanced Multicultural Education Course

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Abstract: This paper describes the use of technology by students and their instructor in a course on multicultural education. In the course Multicultural Foundations of Education, each technology-based course component is designed to satisfy a specific constructivist learning objective. Students engage in online discussions to enhance and reinforce multicultural content learning, explore and develop Internet resources that address a wide spectrum of cultures, and become contributors to a knowledge base accessible worldwide. The instructor uses on-line libraries for class readings, as well as for resources for students and resources related to multicultural education. The use of technology in a multicultural education course allows students to enact a way of being engaged in the world that is essentially multicultural in spirit. When used consciously to create a more student-centered classroom, it allows the instructor and students to engage in a constructivist approach to teaching and learning.

Introduction

At Gallaudet University, the world's only liberal arts university for deaf undergraduate students, a strong obligation exists to press forward in the development and implementation of innovative technologies to support and model visually rich multimedia and hypertextual learning environments. Professors in Gallaudet's graduate programs, which accept not only deaf, and hard of hearing students, but also hearing students, are strongly encouraged to integrate technology into their teaching, and we continually explore ways to enhance our teaching with new technology-based methods and resources to empower visual learning and visual learners.

For those of us who teach in the School of Education and Human Services, NCATE (National Council for Accreditation of Teacher Education) requirements oblige us to indicate in course syllabi how technology is included in the course. At the same time, the guidelines or case studies demonstrating methods for technology integration which address the learning objectives of highly specialized course topics are few. A wider array of models demonstrating how technology can be used effectively to enhance the course teaching is needed. Meanwhile, pedagogical appropriateness and planning for technology training may be overlooked in the rush to mark that "I teach with technology" checkbox done.

The course instructor developed several technology components for the course she teaches on multicultural education. With the support from the Mellon funded Technology Fellows Program, Gallaudet University created the Technology Fellows Program for faculty members who were committed to technological enhancement of their teaching. Over a period of 2 years beginning in the fall of 1996, the

instructor, the first author, worked with an educational technology specialist, the second author, to accomplish this project.

Use Of Technology to Support Constructivist Pedagogy

The appropriateness of the use of discipline specific software applications may be a given in the sciences and mathematics. However, designing appropriate use of technology in classes in other disciplines may require more innovative teaching strategies. Traditionally courses in schools of education, other than courses in computer literacy and applications, have not integrated technology into course content and goals

The landscape of educational technology has been transformed in the few years from the pre-eminence of stand-alone applications, typically with a drill and practice activity focus to "weblications" supporting more active and participatory learning (Dede, 1996). New tools designed specifically to support peer to peer interaction, tele-mentoring, and information sharing, as well as the burgeoning of the Internet for academic publishing, are altering the educational landscape to allow support for more constructivist teaching practices (Berge, 1996; Berge & Collins, 1995).

Two perennial questions, which have shaped the evolution of our plan for integration of technology at Gallaudet, are:

1. What purpose does the instructor's use of technology to deliver course content serve?
2. What impact does requiring students to use technology to accomplish course objectives have on both their current academic success and on their future professional growth?

These questions have been at the core of the integration of technology into the course to be discussed, Multicultural Foundations of Education, as will be shown later in this paper.

Constructivist pedagogy demands that teachers not rigidly follow a textbook, plan in an experimental spirit, and is concerned with seeing that meaningful activities occur in the classroom rather than worry about complying with pre-set objectives at all times (Henderson, 1996). Technological innovation in classroom is a good fit with this pedagogical style. Those of us who teach with technology know that we must anticipate the possibility that something will not work the way we want it to when we want it to. A constructivist educator may be more willing to take the necessary chances that the integration of technology into their teaching requires.

"Education That Is Multicultural" and Technology in the Classroom

Technology has direct applications to multicultural issues that may not be immediately apparent. The following excerpt from *Brave new schools: Challenging cultural illiteracy through global learning networks* describes applications of technology that are central to multiculturalism:

> ...previously silenced voices can now be raised and heard as a result of the greater recognition of human rights and freedoms in industrialized societies during the past 30 years. Modern communications technology permits these voices to be amplified, so that they have become harder to ignore. Official versions of history and even the myths that form the foundation of nationhood are being challenged both inside and outside the classroom. (Cummins & Sayers , 1997, p. 5).

The goals of the course Multicultural Foundations of Education include a focus on issues of educational equity and educational reform in the United States. Because the students are preparing to work as teachers of the deaf as well as school psychologists, and administrators, they learn about theory and practice of multicultural education in K-12 general education and the application of multicultural practice in the education of deaf students. The instructor's goal for herself is to be a model of multicultural competence in her management of the class, teaching, and interactions with students. A constructivist pedagogy allows the co-construction of knowledge to occur with students learning from one another, and the instructor learning from her students. A teacher-centered autocratic classroom is not practicing "education that is multicultural".

What does it mean to practice "education that is multicultural"? This is an educational approach that is philosophically aligned with constructivist teaching. Rather than focusing on teaching students finite bits of information about various cultures in our country, education that is multicultural should be democracy in practice, and promotes social equity and equal educational opportunity (Davidman & Davidman,1997; Sleeter & Grant, 1999). An educator who is preparing future teachers to be culturally competent must teach with a multicultural perspective. This means she must model respect for differences of many kinds including differences of belief, learning styles, races, gender, age, class and more. At Gallaudet University, it also means the instructor must accommodate differences in language and communication mode – spoken English or sign language- and the hearing status of students–hearing, hard of hearing or deaf.

Although there are quality commercially available products such as CD-ROMs available that focus on topics such as Black History or Labor History, these are not used in the course. The focus is on creating new multicultural resources that can be accessed by anyone - K-12 students, teachers-in-training, teacher educators, parents, community agencies, and others interested in multicultural education, and deaf education and Deaf culture. These resources will help meet the critical need in deaf education for information as well as materials on multicultural issues in the Deaf community and schools and programs for the deaf. Approximately 42% of the school-age deaf and hard of hearing student population is from racial, cultural and ethnic diverse backgrounds which has created the need for this information and the Internet provides an ideal vehicle for rapid its dissemination. Rather than have students create projects in paper form, which will be seen by very few people, the Internet allows their work to become resources for other educators in all corners of the country (and world). In this course, the World Wide Web is also used to access a wealth of information relevant to multicultural education. This is done through the use of on-line readings in the course syllabus, the creation of a multicultural resource web library, and by requiring students to use on-line sources for their final paper, which is a case study of a culturally diverse individual.

Technology Applications

In the course, each technology-based course component is designed to satisfy a specific constructivist learning objective. Students engage in online discussions to enhance and reinforce multicultural content learning, explore and develop Internet resources that address a wide spectrum of cultures, and become contributors to a knowledge base accessible worldwide. In so doing, they enact a way of being engaged in the world that is essentially multicultural in spirit. Specifically, students meet these objectives by:

1. Participating in an asynchronous electronic discussion forum where students initiate, online discussion of topics brought up in class, in readings, on campus, as well as in the real world that are relevant to multicultural issues.
2. Working collaboratively in student organized groups to develop web projects that offer resources on multicultural issues for educators, students, parents and the Deaf community.
3. Contributing to and utilizing an Internet multicultural resource library.
4. Reading relevant articles by scholar and practitioners in the field.

Using technology created by Collegis, the Learning Technologies Unit at Gallaudet University has created the Gallaudet Dynamic Online Collaboration system (GDOC). The GDOC system includes the Discussion Forum (an asynchronous online discussion), the Course Center (a database of course materials), and the Resource Library (an annotated dynamic listing of Internet resources). One week of training for the GDOC databases was offered to a pilot group of faculty last spring and summer. Some faculty has begun to use the Discussion Forum. Departments, as well as individual faculty members, are constructing Resource Libraries in their disciplines or for courses. Gallaudet is establishing a syllabus repository (password protected) which will allow instructors to create electronic versions of their syllabi with hot links to readings. Requiring students to use technology to satisfy course objectives in a course that is not about technology presents a number of challenges. Ensuring access to computers, estimating the time needed from both instructor and students to respond to the changes that occur when technology is integrated into the course, assessing technology training needs, and ways to shoehorn technology training into already crowded syllabi are all issues to be addressed. In this course, one class session out of 14 is

dedicated to orientation to the technology used in the course. Students are encouraged to take advantage of training provided by the Learning Technologies Unit in designing a simple web page.

Discussion Forum

The Discussion forum is designed for asynchronous communication. It is similar to a list-serv in that threads (groups of related messages) are created and continued by discussion group members themselves, that the membership is limited to those registered, and the degree of monitoring and shaping of content by the moderator can vary. In this multicultural course, the instructor allows the students wide autonomy to raise and address emerging topics. There can be additional discussion of videotapes shown in class, debate about issues studied in that week's class or sharing of personal reactions to current events as illustrated here:

> As I mentioned in class, K. and I decided to go to the vigil the other night in memory of Matthew Shepard. I was deeply saddened by the entire experience. Sad that such a sick, horrible crime had to occur at all, sad that there was a need for a vigil, and sad that we have to fight to have an anti-hate crime bill to be passed. It was said the other night at the vigil, and I couldn't agree more. In the Declaration of Independence it says..."We hold these truths to be self-evident, that ALL men are created equal, that they are endowed by their creator to certain inalienable rights, that among these are LIFE, LIBERTY and the PURSUIT OF HAPPINESS." Why is it that many, many years ago, our forefathers thought to include this when creating America, yet today, in the 1990's people are STILL being denied these rights? Perhaps as a member of a minority group, I am even more affected by this heinous act...perhaps because I could imagine that happening to me...maybe I'll encounter someone that hates Jews and decides that I don't deserve to live, because I am different than they are…after all, Nazi Germany didn't happen that long ago. Someone in class asked me and K., I think it was L., why we went to the vigil. Beyond being curious, how could we NOT go? How can any of us sit idly by and allow people to torment and terrorize other people? It doesn't matter that K. and I are not gay, because it goes far beyond a gay/straight issue. It is about rights, of all human beings, no matter what their race, religious beliefs, etc. may be. Wow, this is getting really long. I'll get off my soapbox now...any comments? :)

The discussion forum has a number of benefits. Some students, particularly hearing students who are not fluent yet in sign language, are more comfortable participating in an on-line discussion where they can express themselves in writing. Because it is asynchronous, they can wait to submit a response (to post) in situations in which they are not sure they are being clear. When a debate or discussion occurs face-to-face in the classroom, they may worry about their ability to make themselves clear using sign language, having their intent misinterpreted, or blurting things out they haven't thought through. The asynchronicity provides a reflective environment, which allows them the time to think about what they want to say and how to say it.

This discussion forum is a student-guided activity, but instructors have options to use the discussion forum in a several distinct ways. Those instructors who want to control the discussion may establish the threads or assign topics. Instructors have options to evaluate the content of student contributions and grade them. In the multicultural education course, participation is a course requirement, although not all instructors choose to require participation.

Resource Libraries

Resource Libraries are dynamic, collaborative, annotated collections of Internet resources and websites. Students in the class as well as any visitor to the Resource Library can suggest resources. They served several functions in this course:

1. As an adjunct to an electronic syllabus, an electronic library of on-line readings was set up.

2. For specific in-class activities and topics, special categories were set up in the on-line library.
3. The instructor-maintained Multicultural Resource Library with over 200 links to multicultural topics was made available to the larger community through the WWW.

For an in-class activity on bilingual education and language diversity, a set of links was added to online articles and websites. This kind of modification can be done in a matter of minutes using the GDOC system. Both the Resource Libraries and the Course Centers have templates that faculty can fill in to allow the addition of new information and content automatically. The system is dynamic, as its name, Gallaudet Dynamic Online Collaboration, suggests. Students and others who want to suggest (add) resources to the Multicultural Resource Library may fill out a template. However, the instructor must approve new suggested resources before they are added to the course's Resource Library. The instructor may also tally a listing of all resources by contributors which is a convenient feature for assessment at the end of the semester.

Web Projects

Students are required to construct websites in the course, working collaborating on a topic approved by the instructor. All the students are encouraged to learn simple web page construction, but the instructor suggests that students form web project groups that include a class member who has the web authoring skills or the interest to learn. Since adding this requirement in fall semester,1996, the improvement in available Internet authoring tools has reduced students' anxiety about the assignment and improved the quality of student work. The web projects replace paper projects the students formerly did and shared only with their classmates and instructor. Now they can share their work with the world. Student web projects are stored on a department server in order to preserve the sites after students leave the university.

Students' adjustment to some of the technological changes has been slower. Many continue to feel the need to make paper copies of on-line readings. This is sometime a good idea as sites come and go and the information may not be there the next time they go to look for it. As the instructor continues to find better solutions to some of these problems, the use of on-line readings could expand to on-line activities of other sorts.

Conclusion

The integration of technology into a course on multicultural education has been challenging, but extremely rewarding to both students and instructor. Although the instructor is a self-described Luddite (a term reviewed in the first class), these learning technologies have proved their worth in promoting active learning – both the students' and the instructor's – and at the same time provided a lasting resource for the students and the larger community of educators and parents. A few students have considered the course too technology intensive, but many more students have come to the course enthusiastic about the prospect of developing a website and sharing their work with the world. This learning environment requires the instructor to continue to learn new technology tools and pedagogies alongside her students, and in that way, as well to model the constructivist philosophy espoused in her teaching.

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Developing Critical Thinking About Gender

Using Electronic Discussion Groups

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Abstract: The purpose of the project is to examine how electronic discussion groups might be used to enhance the development of critical thinking students in a Bachelor of Education science education course. The first section of the paper is a discussion of how electronic discussion groups were embedded within the curricular framework of a science education course at Acadia University. The second section is a discussion of the findings of how discussion groups how EDGs impacted on the development of critical thinking about gender issues within the context of the course.

Introduction

In the last few years there have been almost daily advances in technology. In many cases the potential for these technologies to enhance learning and teaching environments has not been carefully assessed (Koschmann, 1994). One strategy that has received a fair degree of attention has been the use of electronic discussion groups (Bonk, Appelman & Hay, 1996; Kuehn, 1994). EDGs are often used as a tool to allow students to discuss course issues during out-of-class time. Unfortunately, in many cases EDGs have become yet one more activity for students to complete to meet course requirements rather than a sound pedagogical device to both enhance students' learning and encourage critical thinking. Clearly, there is a need to develop a framework for the use of strategies such as electronic discussion groups if they are to have a major impact on teaching and learning. Further, if electronic discussion groups are to move beyond having students converse informally, and lead towards developing communities of critical inquiry, then we need to explore how to encourage students' critical thinking when engaged in electronic discussion groups.

Encouraging critical thinking about social issues such as gender is an important responsibility. While most, although not all, educators generally agree this is an important goal, there is a general lack of understanding regarding how teachers might approach the important role of developing critical thinking in general and then more specifically about issues such as gender. Ultimately, if we are to change the way women relate to the field of science and pursue careers in science then educators need to think critically about this important issue. However, facilitating students to think critically about issues such as gender is not a straightforward process. The moments when classroom events move towards the critical examination of social issues are to a large extent, determined by the teacher or instructor.

This paper outlines how EDGs were developed with thirty-one students in a Bachelor of Education science education course with the intent of creating communities for critical inquiry. Ultimately, the goal was to use EDGs as a pedagogical technique for facilitating the critical examination of gender issues related to the teaching of science and technology. The first section of the paper, is a discussion of how electronic discussion groups were embedded within the curricular framework of the science education course. As a way a synthesizing the aspects of the pedagogy which impacted on the critical examination, a

framework is presented which outlines how electronic discussion groups might be used to promote critical examination. The second section is a discussion of how the use of EDGs impacted on the development of critical thinking about the issue of gender and teaching science.

A Framework of Developing Critical Discussions

Critical Milieu

Facilitating critical thinking about issues such as gender requires the instructor to provide more support than simply assigning students the task of participating in electronic discussion groups with an expectation that students will begin to view through a critical lens. The classroom milieu, both in-class and in the electronic classroom-work, needs to be supported by a critical milieu. Gardner (1993) suggested that teachers need to embody the message they advocate; they teach not just through words, but through activities. Passmore (1967) pointed out that teachers needs to welcome criticism and set an example with respect to the quality of their critical spirit.

In the science education course and its electronic discussion groups this included the instructors modelling their own critical thinking in an on-going manner with a willingness to call all aspects of the teaching and learning into question. In this context, the students were encouraged to engage in a critical assessment of every aspect of their learning. To develop critical thinking in the EDGs a valuing of critical thinking in general needed to exist.

Meaningful Content

At times, in the zeal to articulate the need for critical thinking, the process of thinking becomes the focus. When developing a critical approach to learning, it is essential that both building content knowledge and critical thinking occur simultaneously (Dewey 1938, Hare 1995, Whitehead 1929). If an aim is to apply critical thinking to the classroom and the world beyond it, we need to be concerned about content. We need to ask about the significance of content and what we are trying to achieve. We cannot make the simplistic assumption that simply that having modelled critical thinking with respect to the interpretation of a text, the conducting of a science experiment, or the solving of a math problem, that students will miraculously become effective critical thinkers about other important issues in their lives.

Within a feminist framework, the view is often held that the curriculum needs to be connected to the ethical, social and political worlds in which we live (Greene, 1990; Martin 1992). In the content of this study three pieces of text were used as a focus for the content. Each selection identified the need to consider gender in teaching science, but the level of explicitness of the gender issue varied. At one end of the continuum was a text in which the authors identified the need to have a "girl-centred curriculum" and at the other was a classroom vignette that profiled a male teacher displaying behaviours that were gender-biased.

Mentoring Discussions

What moves the pendulum from a surface level interpretation to a deeper, more critical analysis is dependent on how members of the discussion group respond to the ideas posted as entries. While students, in many cases and to varying degrees, will possess a critical disposition towards learning and a willingness to think about issues such as gender critically, the degree and quality of critical thinking will likely be influenced by the instructor's participation and mentoring. In EDGs, instructors can offer encouragement, modelling, feedback, questioning, and task structuring that can be adjusted to address perceived student needs and competencies (Bonk & Kim, 1998; Collins, Brown, & Newman, 1989; Palincsar & Brown, 1984) In this context, the instructors viewed their task as one of facilitating the discussion through: direct questioning, pushing students to explore new ideas and sections of the readings, encouraging students to justify positions, focussing the discussion on differing viewpoints, and prompting students participate in a dialogue.

Methods

The research was conducted within an interpretative framework. Thirty-one students were divided into six discussion groups mid-way through a term course. Selections of three texts that focused on gender issues were distributed with two groups assigned to each text selection. Students were instructed to read the text and critically discuss the reading in the electronic discussion to which they were assigned. Although the primary goal was for the students to engage in a critical discussion of issues related to gender, they were not instructed to specifically discuss gender. Over the course of ten days the students, (all of whom participate in "The Acadia Advantage" a laptop computer initiative to integrate the use of technology in teaching and learning) were asked to participate in the on-line discussions.

Using the ACME software developed by the Acadia Centre for Learning and Teaching, students logged on to the system, joined their group, read others' reactions and added comments and reflections. As discussed above, the instructors aimed to mentor the discussion. In a subsequent in-class activity, students were placed in jig-saw groups with members from other discussion groups where they described to others the key issues raised in their own discussion groups. Further, students were asked to respond to an open-ended questionnaire which surveyed their attitudes and beliefs related to gender and the science curriculum.

Since all discussions were saved for in-depth analyses, summary data as well as specific discussions were printed. The summary data determined the number of entries from each student and the times each had participated. Second, the print-out of the six discussions were analyzed to determine the nature of the entries and whether or not there was evidence of critical examination. Further, the entries were analyzed to explore how each entry related to the ongoing discussion, and how students responded to the probes and comments of the instructors.

The content analysis of the discussions recorded the following forms of discourse: (1) social acknowledgements of another's point, (2) unsupported claims and opinions, (3) justified comments, (4) questions and dialogue extensions to raise new issues, and (5) instructor mentoring. We were particularly interested in how students justified their positions and their ability to engage in dialogical interactions with their peers. Further, we were interested in whether or not students responded to the mentoring attempts made by the instructors.

Questionnaires were analyzed to determine how students justified their positions regarding gender in a post-discussion forum, and to see how they viewed their participation in the discussion group.

Discussion

Content analysis of the transcripts of the discussions demonstrated that electronic discussion groups created a context for critical thinking however, evidence was demonstrated in terms of degrees. In some cases students' thinking was clearly critical while in other cases students resorted to giving unsubstantiated opinions and reactions. Clearly the content of gender evoked an emotional response in some students. For example one student stated, "The feminist make it a much greater deal than it actually is. As long as we treat each other with respect and sincerity regardless of sex then don't worry about gender issues, they will fall in place automatically. Overall I didn't change my views in this activity I confirmed existing ones." Yet, for others a forum was created in EDGs to reflect on past experiences through a new lens, to think and express one's thoughts as well as listen to others. Entries in the discussion fell into two broad categories: 1) logical thinking, and 2) dialogical reasoning. In all groups there was evidence of both forms of thinking although they were not consistently demonstrated by all students.

Logical Reasoning

Paul (1992) suggests that objectivity and rationality aimed at discovering truth are crucial to critical thinking. This involves reasoning and the use of logic. Critical thinking involves "figuring out" that which cannot simply be a matter of arbitrary creation or production: "If what we figure out can be anything we want it to be, anything we fantasize it as being, then there is no logic to the expression "figure out" (Paul, 1992, p.18). Students used the discussion groups as a place to dissect and reflect upon the text selection and to try to analyze the texts in a critical way. For example, one student stated in reference to the classroom vignette, "Talking constantly about cars, trucks and football certainly doesn't make the girls

feel too much a part of the class. Furthermore, the teacher allowed one girl's frustrated reaction to be called upon to volunteer an answer, to prevent him from ever asking her again. He could have used group work, one on one tutoring or better yet, peer tutoring, where Krista might have been able to aid some of the other students, thereby sending the message that girls can do Science and do well." Many students used the EDG as a place to articulate reasons for being concerned about gender. For example one student wrote, " I don't really think I fight for equality because I think that men and women are different. I would like to think that the world would be a better place with both men and women taking a bigger role in all aspects of life, but I am not oppressed by the entire male population." Student used logic to present arguments for example one student wrote "I think we are all equal, and the idea that men are more dominated in the education system might be true, but I don't think we should flip it around and have the women the most dominant. That would be a contradiction."

Dialogical Reasoning

While the discussion groups set up a context where students could state their views and outline a justification one of the major benefits of participating in a group discussion was that the students had an opportunity to dialogue. In critical thinking one needs to consider more than their own personal views. In dialogical reasoning it is important to understand that the purpose is not merely to think about the perspective of others, but to examine one's own ideas, and those of others, in a search for the truth. In many cases in the questionnaires students referred to the fact that their thinking was influenced by considering the views of others in their group. One student stated, "this activity made me realize that I am more comfortable with males. Had I not been made aware of this, I probably would have unconsciously made my male students more comfortable in class.

Because of the complexity of social issues, and the fact that examining issues from multiple perspectives assists in highlighting these complexities, moving between one's ideas and those of others, with an openness to consider other ideas and revise one's thinking in light of new information, is essential. Through the use of dialogical reasoning, more information is made available for analysis and evaluation. One student stated, "In the discussion groups on ACME and the people in-class told stories about first had experiences of gender-bias. It is one thing to read about it in papers, but to have students who are actually in class with me now relate these stories is more real." Thayer-Bacon (1993) argues the point that there needs to be care for other peoples' ideas. Caring and valuing others' ideas form the basis of the dialogical process, and are an important part of critical thinking.

Mentoring

The level of response to the instructors' attempts to facilitate the discussion varied. In some groups the probes of the instructors were completely ignored and in other cases the instructors probes encouraged the students to step back and analyze the problem in a different light. If the probes were made in the form of stating a position and asking students to agree or disagree, dialogue was stimulated. For example this probe was offered in the context of a discussion about the view that more boys are interested in the sciences to encourage students to justify their positions. The instructor stated, " Student interest in examining content can be tied to previous experiences, agree? Disagree? If this is the case then don't we as teachers help to construct on-going interests of our students?" Other probes, were offered to encourage students to reflect back on previous experiences. These probes often resulted in the students stepping back and reconsidering past experiences. For example, in response to an entry which stated "I wasn't brought up in a male dominated education system" the instructor asked, " When you studied history, geography etc did you get an understanding of what life was like for women as well as men? When you studied science what was the context of the discussion on evolution? How were women represented in the world of science?" This probe resulted in several students participating in the discussion with commentary on their schooling experiences.

Other probes, less directly linked to the discussion were made by instructors to change the direction. These probes were often ignored or only responded to by one student. There appeared to be a need for the instructor to participate in the discussion as a member of the group rather than as someone who came in and controlled the discussion.

Concluding Comments

Electronic discussion groups provide a promising strategy for encouraging the development of critical thinking. In the case of the science education course discussed in this paper, critical inquiry was evident in the discussions although the degree and the depth of the inquiry varied. From the perspectives of the instructors, the classroom milieu was an essential component of establishing the communities of inquiry. Without a critical edge to the teaching and learning in the course, it is doubtful whether the students would have engaged in the same quality of discussion on-line. Equally, it was important for the students to have the challenge of thinking about important content such as gender. Thinking about gender issues has political importance and is linked to moral issues of social justice. This kind of content is foundational to the political and social worlds of the classroom and schools in which these students will eventually teach. The instructors viewed their role as one of making gender important in the curriculum and facilitating a critical examination. The instructor mentoring entries into the discussion generally encouraged students to justify their positions and reflect on their own or the experiences of others, therefore enhancing the development of critical thinking.

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Creating Gender Equitable Computing Classrooms: A Model Project

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Abstract: Project *FOCAL* Point is a multi-strand project designed to increase female participation in the computing sciences. The project targets two crucial groups: high school computing teachers and female high school students. Features include a two-week teacher workshop, a one-week Computer Camp for Young Women, mini-grant projects and a follow-up conference for teacher participants, and listservs for both teacher and student participants. This paper focuses on the teacher participant responses and reactions to the two-week teacher workshop during the project's inaugural (pilot) event.

Introduction

Few people doubt that technological skills will become increasingly important as our country enters the 21st century. Specifically, the demand for qualified computing professionals already exceeds the supply and is expected to double in the next decade. In view of the high percentage of Caucasian males currently employed in the field and continued national concern with affirmative action, businesses continue to seek out qualified women and people of color. However, despite acknowledged career opportunities and known financial advantages, these groups continue to be under-represented in the professional work force and in technology-related majors (Frenkel, 1990; Scragg & Smith, 1998). Concerned educators must question the reasons for the continued imbalance and search out avenues for addressing the equity problem.

Background

More than a decade ago, Lockheed and Mandinach (1986) expressed concerns about the high school computing curriculum. Reporting on declining student interest, the authors claimed that some of the decline was due to the poor quality and restricted curriculum of many high school courses. They reported that teachers were often minimally trained and that courses were "inadequate in scope, depth, language choice" (p. 23). Students who subsequently enrolled in college courses had first to unlearn unsuitable techniques and misconceptions. The authors' findings are consistent with those of others who researched pre-college computing students' understanding. After weeks of instruction, respected researchers have reported that many students lacked even rudimentary understanding of computing or programming concepts (Lockheed & Mandinach, 1986; Putnam, Sleeman, Baxter, & Kuspa, 1986).

One factor contributing to the poor quality of pre-college computer science education is certainly the quality of the pre-college computer teacher's training. Lack of adequate training is a widespread problem. If we believe the literature, the impact on girls—who internalize failure; who do only what is assigned in class (Linn & Hyde, 1989); who feel alienated by an unfriendly computer culture; who respond positively to collaborative, constructive learning environments, etc.—is proportionally more negative than it is to boys.

Teachers bring to the classroom a lifetime of experiences that strongly influence the way they think about teaching and learning (Ball, 1988; Lortie, 1975). Many teachers of technologically oriented subjects have been educated in didactic and competitive classrooms. For most of their lives they have been passive learners, and many are quite comfortable in that mold. These teachers look at their best students, and the students, too, are passive learners. If teachers are to change their way of thinking and teaching, they need more than a general awareness that collaborative and constructive learning can be helpful. They need compelling evidence that the techniques will work for them and for their students, and they need it in the form of documented successes. That kind of success requires training, practice, and opportunities for reflection and sharing—precisely the experiences Project *FOCAL* Point provides.

Many rural and other schools, with limited financial resources, have no licensed computing teachers on their staff and cannot afford to hire one. These schools have two choices: either ignore computing altogether or allow under-prepared teachers to teach the subject. Neither choice is ideal. Project *FOCAL* Point offers a desirable alternative. It provides teacher participants with initial computing instruction, perhaps providing the foundation and incentive for continued study.

Project *FOCAL* Point: Implementation

The overarching goal of Project ***FOCAL*** Point is to increase female participation in the computing sciences. Specific objectives as related to the teacher participants are to:

1. Acquaint teachers with gender issues as related to computing (e.g., statistics regarding females in the field, demand for computing professionals, obstacles to success, etc.).
2. Help teachers become aware of unconscious biases they may possess about the culture of computing.
3. Introduce teachers to instructional practices known to appeal to women and girls.
4. Provide teachers with career information.
5. Provide teachers with technology-related content knowledge and skills.

The detailed objectives are largely addressed through a two-week summer workshop. The teacher workshop is a blend of training in gender issues, computer and information systems concepts, and computer and network applications—with some portion of each day devoted to each dimension. Workshop instructors incorporate a variety of active and constructive instructional strategies and delivery methods, modeling the teaching behaviors we hope to inspire.

Gender bias awareness activities range from drawing a computer scientist to examining print material and other media (textbooks, movies, television shows, software, language, greeting cards, toy store aisles) for gender bias to developing sensitivity to gender-biased language. These active learning experiences are designed to arouse awareness of gender issues as well as inform practice directly. Guest lectures, videos, and workshops round out the exposure to gender issues. A concrete models workshop (where groups work together to write directions for constructing a Tinkertoy machine) conducted by the authors, for example, has repeatedly revealed consistent (and disturbing) patterns of male-female interactions and role choices when mixed gender groups work to solve a technical problem (Madison, Gifford, & Kepner, 1997).

As enhancing teacher participants' skill and knowledge of computer and network applications is a major project objective, teachers early learn to navigate the university network. Next, they practice with e-mail software and public folders. Those skills accomplished, they join the community's discussion list and practice posting messages there. The basics accomplished, the teacher participants learn to navigate the Internet. Particular emphasis is placed on locating gender-related sites, evaluating sites and information relative to their appeal to

girls or women, and developing female-friendly Internet lessons for use with high school girls. Lastly, participants acquire the basic skills of web page production.

At first glance, instruction in these topics may seem unnecessary. It is easy to assume that everyone uses e-mail and "surfs the net." Experience with college students has shown this not to be the case. Each semester the authors come across computing students—including advanced computing students—who have not yet ventured into cyberspace. Moreover, the college students regularly volunteer that they would not have done so had it not been a course requirement. The literature offers that women are more likely than men to do only what is required of them in class (Linn & Hyde, 1989), to feel less efficacious with computers (Bernstein, 1991), and are more likely to feel alienated by a culture they view as impersonal, unfriendly, and withdrawn (Spertus, 1991; Turkle & Papert, 1990). Efforts must be made to expand the teacher participants' computer comfort zone and to help them identify more positively with the computer culture, so that they may more effectively teach their students. During the second week of the workshop, teacher participants pilot test their female-friendly technology lessons with high school girls attending a Summer Computer Camp for Young Women. The remainder of the paper elaborates on the inaugural session of the teacher workshop.

Evaluation Study

The evaluation study attempted to answer the questions:

- What changes in computer attitudes did teachers report as a result of their participation in Project *FOCAL* Point's two-week teacher workshop?
- What changes in computer skills did teachers report as a result of their participation in Project *FOCAL* Point's two-week teacher workshop?

The participants were seven computing or technology teachers (four men and three women). Six taught high school and one taught computer applications at the local technical college. All teachers applied to participate in the project. Since response to the call for participation was nominal, all applicants were accepted. As reported on their applications, all had taught a computing or technology-related course and expected to do so again in the foreseeable future. All lived and taught within two hundred miles of the university. Non-local teachers stayed in a residence hall for the duration of the workshop; all four chose to return home over the weekend. There were no fees associated with the project; moreover, teachers received three tuition-free graduate credits. Participants signed informed consent documents before any data were collected. The small sample size precludes inferential statistical analysis; hence only descriptive statistical analyses are reported.

The Computer Attitude Scale (CAS) was used to measure computer attitudes. The 40-item CAS has been shown to be valid and reliable (Loyd & Gressard, 1984; Loyd & Loyd, 1985). The CAS is composed of four 10-question sub-scales designed to measure computer anxiety, confidence, liking, and perception of usefulness. Items on the CAS with negative wording were re-recorded so that for all items, a higher item score indicates a more favorable attitude.

The teachers completed the CAS on the first day of their project participation to use as a pre-test measure and again on the last day of the summer program. (The second questionnaire serves as an interim post-test measure. It will be completed again after one year and at the project's conclusion.) The results are shown in Figure 1.

We did not expect to see dramatic changes after two weeks; however we did expect that scores would not decrease. That expectation proved only partially true. The mean for computer anxiety increased slightly (0.57) and the mean for computer confidence remained constant. In contrast, the mean for computer liking and usefulness decreased slightly. However, none of the changes are great enough to have any practical significance. With such a small data set, every answer has a large impact on the outcome. Moreover, several of the teachers observed that the negatively worded questions were hard to read. For example two teachers strongly disagreed with the statement "Computers will not be important to me in my life's work." on the pre-test and strongly agreed with the statement on the post-test. Although it is possible that the two-week workshop effected such a dramatic negative change, it seems unlikely. A more plausible explanation is that the participants misread the question. Given the small sample size, the responses have a large impact. Finally, there is likely a ceiling effect due to the high mean scores on the pre-test. The mean for each sub-scale could

range from a low of 10 to a high of 40. The high pre-test means (37-38) make it difficult to detect changes. The pattern might well change with a different cohort.

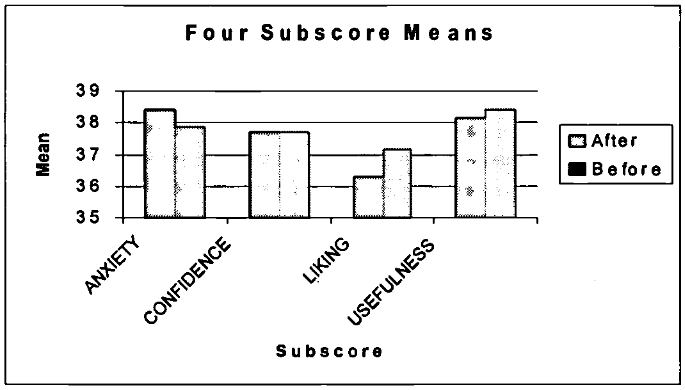

Figure 1. Computer Attitude Scale Results

The teachers were asked to complete a self-assessment of their computer experience on the first and on the last day of the two-week workshop. Figures 2 to 5 show the before/after difference in reported computing experience levels. A comparison of the before and after means show that perception of electronic mail and web

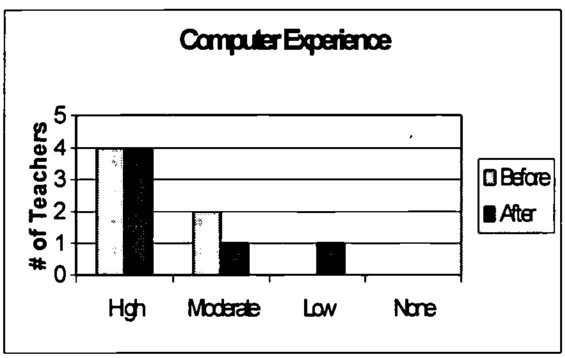

Figure 2. Computer Experience

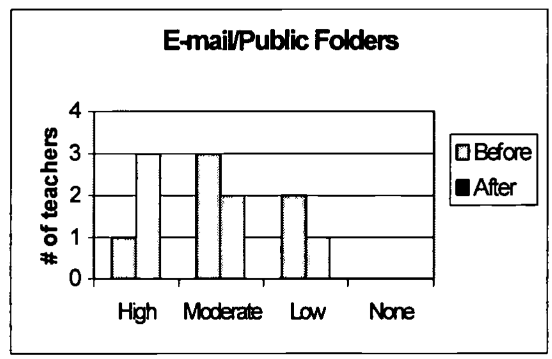

Figure 3. E-mail/Public Folders

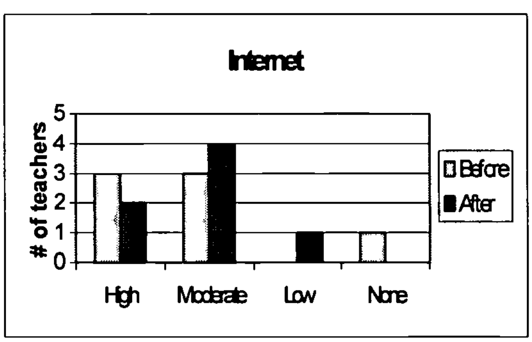

Figure 4. Internet

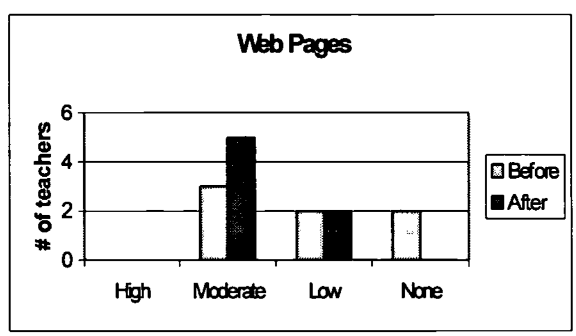

Figure 5. Web Pages

page development experience increased dramatically. The latter statistic is not surprising since five out of seven teachers (71%) had not constructed a web page prior to their participation in the summer workshop. Ability with Internet searching increased slightly, and assessment of general computer experience dropped slightly. The latter statistic may be skewed negatively, as one of the technology education teachers had done little more with the computer than use AutoCad prior to his participation in the workhop. He admitted to being challenged by the workshop; he was, in fact, not comfortable enough with the technology to attempt to teach

web page development during the second week of the workshop when the high school girls were there. Too, some teachers may have overestimated their experience level before they observed what others were doing. Unfortunately, the experience questions were (unnecessarily) tied to other project evaluations and therefore anonymous. Hence, it is not possible to draw a firm conclusion regarding the reason for the decline.

Not surprisingly (given the audience), 83% (five out of the six teachers) of the respondents agreed or agreed strongly to use e-mail or public folders in their teaching. More interesting would be the reasons for the lone respondent who responded in the negative. The teachers astutely observed that "some female students might not want to ask the questions in person, but they would ask questions through the e-mail." The authors add that this observation is probably true for more reticent males, too. From these responses, it is possible to conclude that e-mail will play an important role in the future teaching of the respondents. Can we conclude that the participants might reach more students, especially those that might "fall through the cracks"? Possibly. Once again, given the audience, it is not possible to conclude definitively that the positive response is a result of the workshop. Five out seven teachers, (71%) responded that they wanted to use Internet searching in their classroom. At least one responded that he or she was grateful for this opportunity to learn more about this new computer technology. Once again, given the audience, it is not possible to conclude definitively that the strong positive response is a result of the workshop.

As is customary for conferences and workshops, participants were daily asked to rate the individual seminar sessions. The scale ranged from Very Useful = 1 to Not at All Useful = 5. The inverse rating scale was selected intentionally to avoid the bias that could be created with the notion that "more is better." The teachers' responses to the individual sessions are shown in Table 1. The uniformly positive ratings (ranging from 1.0 to 2.0) indicate that the teachers generally found the workshop useful.

Session Name	Session Type	Rating (Mean)	# of 1's
The UWSP Campus Computing Environment	Lesson	1.67	4
Using Concrete Model to Teach Programming	Guest Presentation	1.16	5
E-mail/Public Folders using Microsoft Exchange	Lesson	2.00	3
The Internet	Lesson	1.28	5
Where CAN'T You Go On the Internet?	Guest Presentation	1.42	5
The Internet, Developing Web Pages	Lesson	1.28	6
Gender Issues	Lesson	1.42	4
Developing Web Pages, Computing Concepts	Lesson	1.28	5
Teaching Music on the Web: Technology and the Humanities	Guest Presentation	1.42	6
Teaching and Learning on the Internet	Lesson	2.00	3
Developing Web Pages, Computing Concepts	Lesson	1.42	4
Gender Issues	Lesson	1.42	4
The Top 12 Reasons the Internet is Very Scary	Guest Presentation	1.00	7
Gender Issues	Lesson	1.57	4
Mini-Grant project Brainstorming	Workshop	1.57	4
Lesson plan development	Workshop	1.71	3
Evaluation	Guest Presentation	1.42	4
Mean Rating		1.47	

Table 1. Session Evaluations

Equally encouraging are the responses to the question: "What are the most important things you learned in your role as a teacher?" Responses to the open-ended question included:

- [The workshop] called attention to my behaviors that put down female students.
- I use gender[biased] language with students and had not been aware of it--'you guys'.
- I am going to try call all my students by the first name and to encourage girls work together in computing and technology related fields.

- I need to use more concrete models in my instruction.
- I need to utilize more cooperative learning in my classes.
- Concrete models for abstract ideas---most important for females.
- Concrete ideas for making my class more friendly.

Although not overwhelming, there does seem evidence that the workshop was successful in meeting its objectives. The session ratings provide evidence that every teacher found something of worth. The open-ended comments suggest that there may be more female-friendly classrooms as a result of the workshop. Moreover, the participants perceived themselves as being more skillful and experienced at the close of the workshop than they did at its inception. Researchers studying the barriers to female retention in computer science at the State University of New York at Geneseo concluded that females were turned away before they ever reached the university (Scragg & Smith, 1998). Their recommendations: summer workshops for high school teachers and summer camps for girls. Project *FOCAL* Point is an exemplar of those recommendations, a model program that can be easily replicated by concerned computing departments nationwide.

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Gendered Voices: Provocateur in an On-Line Virtual Conference Course for In-Service Teachers

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Abstract: This paper is a report on the findings of a study conducted on a graduate level virtual conference summer school course. Discourse analysis techniques were used to examine the resulting transcript of texts for evidence of a democratic discourse within a community of learners. Findings indicate that gender is not masked in the text driven discussions on the Internet. Distinctive discursive styles are often sex class linked. Like face to face or classroom contexts, status is accorded unequally within discourse communities. Participants are not equal and are not equally attended or responded to. Educators need to take a serious and wary approach to accepting claims of ensured democratic participation in computer mediated communication formatted classes.

Introduction

Classroom discourse has been recognized as important to the educational experience of students. "Speech makes available to reflection the processes by which they [students] relate new knowledge to old. But this possibility depends on the social relationships, the communication system, which the teacher sets up" (Cazden, 1986, p. 432). Vygotskian concepts concerning semiotics and the mediation of higher mental functioning by tools and signs (including speech and language) have been used by cognitive scientists and educational researchers (Bruner,1990, Wertsch, in Moll, 1990) to study the intimate relationships between discourse and learning. Vygotsky was concerned with how the "forms of discourse encountered in the social institution of formal schooling provide the underlying framework within which concept development occurs" (Wertsch, 1990, p.116). New concepts of classrooms and formal schooling have come of age with the advent of the use of the Internet and virtual conference forums and seminars. New forms of discourse are taking place within these virtual classrooms. Computer mediated communication involves electronic discourse. This is a written form of communication that reads like speech acts of conversation. Davis and Brewer (1997) have referred to this quality as "writing talking" (p.2). Computer mediated communication is different from face-to-face conversations in important ways. Participation is asynchronous and often there is a time lag between the initial posting of a message and the responses it generates. Interactivity can be delayed by minutes, hours, days. Every participant has equal access to the conversational floor and turn taking is never an issue. Software formats delineate each participants' contribution as a separate entity and it is listed in the order received. Speakers within these conversations are not able to talk over or interrupt another. Participants are able to refer back to previous speech acts within a discussion thread in ways that face-to-face experiences never afford. Conversations are scripts that are archived and saved as transcripts. Claims have been made "that the electronic medium exercises a democratizing influence on communication" (Herring, 1992, p.250). This claim is the focus of this study. If opportunities to engage in reflection and conversations are opportunities for learning, it is vitally important to be aware of the patterns of discourse being used in this new medium of communication. Is it really true that there is more equality of participation in discussions and with the lack of nonverbal status cues are these electronic forums classrooms where power and control do not mirror society's status quo?

The Study

Electronic discourse within computer mediated virtual courses supports conversations of practice and learning. There are performance features within these conversations that can be studied using the same focal lenses used to examine face-to-face conversations. Conversations have negotiated meanings and values in either context. Is there a dominant speaker, one who contributes the most text, introduces the highest number of topics, receives the most number of directed speech acts? What are the frames (Tannen, 1996) set within the conversations? How do the participants position themselves within the conversation, within the discussion group? Are particular stances sex class (Tannen, 1996) linked? Are there participants who are not "listened" or attended to?

Transcripts were collected from a graduate level virtual conference seminar course taught during summer session, 1998 at Northern Arizona University. Participants were in-service classroom teachers. A kindergarten through high school grade range of classroom assignments was represented by these teachers. Course work included outside class reading assignments of selected current research in the field, a final research paper, and active participation in the on-line discussion forum with focus questions by the instructor. The seminar offered was a Tools for Teachers course designed to promote reflective practice. Seven teachers from four different communities participated in this pilot course during the summer of 1998. Five of the participants were female and two were males. An interactional sociolinguistics (Schiffrin, 1995) approach was used to examine the texts of conversations. This approach draws upon concepts of culture, society, language, and the self. The meaning, structure, and use of language is socially and culturally relative (Gumperz, 1982). Meaning in dialog, like that of conversation, is socially constructed. Data was also examined for evidence of micro displays of sex class linked gender identities; displays that are commonly associated specifically with either gender. An example of this is the use of tag questions. Female participants, much more so than males, tend to use tag questions as a discourse strategy to invite response and inclusion or solidarity within the group. (Tannen, 1994) Simple quantitative analysis was done to determine total lines of text generated by each participant, amount of participation, total sums of questions, statements, as well as number of directed responses sent and received. Patterns of participation were mapped/graphed and correlated to the contexts of interactions. Style, register, and "voice" or tone analysis were also used on the data sets to try to discover the dynamics among the participants.

Findings

"C___ [male], I hope I'm doing this right. I thought your observations were right on target. I subbed for high school and jr. high classes. High school was the best. I definitely felt the kids were on my level. They either took repsonibility (sic) or they didn't. How neat to have such a small class, but more importantly to know the parents as well as you do. .... How does that work where you're at? Do the kids have problems that need home visits or is it even necessary in such a small town?" [S]

This example of a speech act from the summer school course illustrates the hedging, expressions of support and appreciation, and use of directed questions to elicit a response described by Herring (1996) as a Supportive/Attenuated style. This is a communicative style sex class linked with female participants. S has been teaching for over 15 years in elementary classrooms. She links some of her experiences with this beginning high school teacher. It is no accident that this just happens to be a male participant. The speech act was written during the second week of a five week course. C had joined the course the second week. S was responding to his first posting. Note that her beginning sentence sets a tentative tone "I hope I'm doing this right." that tempers her statements concerning her own experiences. She encourages C twice concerning his observations and knowing his students' parents well. She further empowers and encourages C by asking two direct questions, inviting C to talk more about his experience.

Contrast S's speech act with the following from D, a male middle school teacher who has been teaching for two years.

"I tried something different, I read the remarks first and will reply, then I will read the assignments. Since M [female] is the only one who has responded so far, here goes. M, I agree that "schools who supported

reforms, who have teachers collaborating and are used to restructuring are more successful." However, as we have already discussed, the changes and reforms need to be bottom up and not top down. In C. county... we have district curriculum, but it includes so much that practically every teacher except the newbies know that they can't possibly cover everything in most of them. Instead, they pick and choose those they feel are most important and cover them. Now the district (top down) is mandating benchmarks for departments. These are designed to put every class at the same point at the end of each quarter or semester, since ____ has such a transient population. That way each student can receive the same material no matter where they are. In theory it sound (sic) great but it doesn't give teachers the flexibility to teach to the students according to their needs. It also varies greatly by the so called "curriculum specialists" who are supposed to be leading the effort. Some curricular areas are nothing more than dictatorships, telling teachers what they will be doing. Others, such as my math curriculum specialists, have given total freedom to our teachers to design our own benchmarks.... so I guess my point is that standards, benchmarks, or curriculum guides can be very benificial (sic) if teachers have direct input into the documents. If not, they're likely not worth the paper they are printed on." [D]

This is one of D's shortest speech acts. The register is a little formal, a little distant and the tone intent is that of a lecture. He has directed this speech act at M, an experienced middle school teacher. The initial construction, "M, I agree..." reads as if it might be the beginning of a supportive communication like S's to C. Reading on reveals the true nature of the communication. It is an opportunity for D to display his knowledge and opinions in neutral, informative style that slips into the use of sarcasm when referring to "so called curriculum specialists". Herring (1996) posits that this is a male voice. D does use three modifiers. "I tried" in the first sentence and "here goes" in the second sentence. The last modifier is in the second to last sentence when he writes, "so I guess my point..". Each of these modifiers serves to soften the tone of authority that underwrites this communication. This sample is very typical of this participant in tone and style.

Looking at the data quantitatively, D contributed 32% of the lines of the seminar transcripts. There were 1,420 lines of communication and D wrote 450 of these. The next closest in number was S who contributed 314 lines. These results are similar for the number of speech acts. D had the highest number with 18. S and K (female) tied for second highest with 15. With this analysis alone, it might not be safe to say that D dominated the discourse. Further analysis of who received directed responses and who sent directed responses revealed an interesting pattern, see [Table 1].

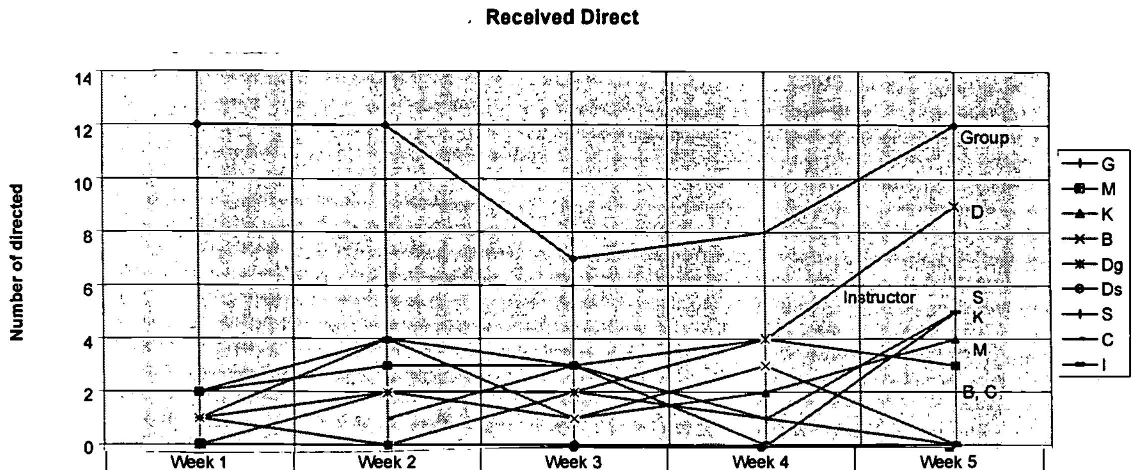
D was clearly the most active participant, the most verbal text contributor and he was the participant who received the most directed responses. Initial speculations looking at the study data were that the females who used active discourse strategies to solicit responses and engagement by other participants would receive more directed responses. This did not turn out to be the case. K (female) sent 36 directed responses, the highest number of the seminar. She only received 12 directed responses in return. The most disturbing of all data was Ds (female) who sent 4 directed responses and received none. Ds participated the least, only 43 lines of text. The following is a representative example of Ds's discourse style.

"Wow what a good article, I personally use (sic) to read. I read a lot, I mean an inch or two thickness of books. Now, I have been molded into "the student teacher" So lately, I've read for credit, now I need to get back into "read just to read".

I think that the video club idea, about teachers seeing each other teach is interesting. I could see a lot of attitute (sic) come up in a situation like that. But I think that everyone would need to respond professionally and always have a good intent. I know that we have been told of something about ourselves that we do and are unaware of. .... This is a nice program, and I hope there is something out there for Music teachers. We are constantly decided (sic) on what pieces to buy, a similar discussion on music would be neat. If you know of any let me know ☺"

Ds had just finished her student teaching and so was the lowest "status" of the group as far as teaching experience. She alerts the seminar group to her status in this communication. Ds is a Native American for whom English is a second language. None of the participants responded to Ds. The important questions here concern why Ds's participation was marginalized. Her participation was not attended to, not responded to. Was this because of her writing or grammatical style? Was it because of her tentative comments such as "nice program"? She is the only member of the seminar to use an emoticon which has been sex class linked to females. It is highly likely that her gender, her ethnicity and her lack of experience as a teacher all were communicated through her text based communication and conspired against her. Ds was not

seen as a competent participant in the discussions. Ds did not participate actively in the on-line seminar. The lack of response was surely discouraging.



	Week 1	Week 2	Week 3	Week 4	Week 5
G	12	12	7	8	12
M	2	3	3	4	3
K	1	4	1	2	4
B	0	2	1	3	0
Dg	1	0	2	4	9
Ds	0	0	0	0	0
S	1	2	2	1	5
C		1	3	1	0
I	2	4	3	0	5

Weeks

Table 1: Mapping the number of directed responses received by each participant each week. G represents the total group. A number of responses were directed to the group as a whole.

K was an experienced participant in on-line discussion groups. She was a member of a state-wide program funded with an NSF grant that maintained a discussion forum with teachers across the state. She is the participant that sent out 36 directed responses and only received 12 directed back at her in return. If linguistic/technological competence is not the issue here, what were the dynamics that determined if a participant was read and responded to?

Further examination of D's speech act communications reveal a style of Absolute. D always made statements in a tone of challenge.

Example "...Yet the public continues to believe that it is the students, teachers, and school who are failing. Once again, I will return to the idea of Obsolete. We are not failing, the system is obsolete!!!"

On the first couple of passes through the data I had missed the significance of the style. D was not only holding court and lecturing throughout the whole seminar, he was also inviting participation and response from others by being a provocateur with his strong, emphatic stances. The female participants explicitly asked for responses with direct questions while this male individual invited response with challenges.

Conclusions

D's linguistic strategies were the most successful in this seminar. This is not the equal, level playing field that some champions of the technology have promised. The discursive style which incorporated stances of the provocateur marginalized Ds's contributions. Ds did not have a repertoire of strategies to discourse successfully with D.

D never directed a response to the only other male in the seminar. D was clearly performing his linguistic routines for the "ladies" of the seminar. Did this also marginalize C who was the second lowest

contributor in the seminar? Was this the dynamic that interfered with K's attempts to solicit response? Is this the linguistic display of a high status male that the female members of this seminar responded to? How could K as a female member of this linguistic community successfully compete?

Are there linguistically competent strategies that we should be teaching our students enrolled in virtual conference, web based courses? At the very least, we need not perpetuate the myth that all Internet communications and virtual participants are treated equally. They are not. Nor are their genders or linguistic indicators of social status masked. As educators using the new technologies to extend and promote learning opportunities for more and more students, we must provide some kind of scaffolding and protection for students like Ds who do not bring the same cultural contexts or linguistic experiences to the virtual conference table. Rather than a "democratic" appearing free-for-all that can lead to unequal power for participants like D, an experienced male provocateur, we should be setting up some explicit expectations and rules for participation in on-line discussions. The next virtual conference course will have a requirement that every participant in a discussion group must respond to all members of that same group within a two week time period. After careful analysis of the transcripts from this virtual conference seminar, it is apparent that equal participation on-line requires careful support and planning with some rules concerning attending and responding to other participants.

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Beyond Tipis and Tomahawks: Using Internet Images to Combat Native American Stereotypes

Lee Montgomery

Verlinda Thompson

Abstract: Since the misuse of images in movies an on television plays such a significant role in the creation of Native American stereotypes, it seems only natural that the proper use of images can be a powerful tool in combating them. Thanks to reasources available through the Internet, educators have hundreds of images at their disposal which can be easily incorporated into an anti bias curriculum which promotes acceptance for cultural diversity. Incorporating pictures which address stereotypes into anti bias activities helps students develop skills in visual literacy and critical thinking and provides a foundation upon which students and teachers can begin to build acceptance of and respect for Native American and other diverse cultures.

Native American Stereotypes

Like many Native Americans, I breathed a huge sigh of relief when the last float of the Macy's parade disappeared from view on my television screen to signal the official end of the Thanksgiving season. Coupled with Halloween, the Turkey Day Bacchanalia forms what Michael Doris calls the "annual twin peaks of Indian stereotyping." Like many who share my ancestry, I had watched with a curious mix of emotions as my son and his elementary counterparts decimated reams of rainbow colored construction paper to make the obligatory headbands for their school Thanksgiving pageant a few days earlier. Decked out in brown paper grocery bags (which teachers the world over seem to think make excellent "Indian clothes") and smeared with face paint left over from Halloween , my son cavorted around the stage acting like, well, a wild Indian. On cue, he sat, (Indian style, of course) and took part in a reenactment of an historically improbable feast in which his only line was predictably, "How!" My son's teacher, along with her colleagues across most of North America, had done her bit to perpetuate Native American stereotyping.

But elementary school teachers are far from being the worst offenders when it comes to perpetuating Native American stereotypes. Secondary school students, like most visual media junkies, formulate images of Native Americans based on films they see in theaters and on television. They routinely see American Indians presented as noble savages (the benevolent Lakotas in Dances with Wolves) or just plain savages (the entire Pawnee nation in the same film). Generally though, since television and films seldom offer realistic depictions of Native Americans in contemporary contexts, students tend to view them as cultural dinosaurs: interesting but extinct.

Lippmann (1961) defined stereotypes as "pictures in our heads" and suggested that we acquire from society pre-defined images of the world in the form of stereotypes before we actually see and experience it firsthand. He viewed stereotypes as a technique for preserving status in society. Lippmann proposed that stereotypes are "the projection upon the world of our own value, our own position, and our own rights. They are the fortress of our tradition, and behind its defenses we can continue to feel ourselves safe in the position we occupy." He further postulated that any attack on cultural stereotypes is likely to be viewed as an attack on the foundations of an individual's status in society.

Stedman (1982) and other researchers examined more specific impacts of popular media on the creation, reinforcement and perpetuation of stereotypes of Native Americans. According to Stedman, the following misconceptions dominate films in which American Indians are depicted. All Indians talk like Tonto. They all look, think and talk alike. They fight at night and howl constantly during attacks. They torture their prisoners and scalp the slain. Indians wander like nomads and are all expert outdoorsmen. They worship a being called "Manitou" and can't resist fire water. They lust after white women (which is understandable since they have no spouses or homes of their own) and they speak a common language called "Indian."

The image of the Native American warrior has a particularly strong influence in popular culture. Some specific examples include the use of the native warrior images in advertising and sports team names (the Cleveland Indians, Atlanta Braves, and Washington Redskins, for example). Atlanta Braves baseball fans use a "Indian war chant" to salute their team and a popular advertising campaign further evoked images of savagery by urging fans to attend baseball games where they could watch the Braves "surround their opponents and beat them with sticks." In addition, the savage stereotype is often invoked in the names assigned to military equipment (Apache and Iroquois helicopters, Tomahawk missiles and the like).

As part of a study of Native American education a Senate subcommittee conducted a survey on Native American stereotypes in 1969. After more than two years of research, the committee found that white society consistently viewed Native Americans as being lazy, drunken and dirty. The committee further concluded that "the basis of these stereotypes goes back into history—a history created by the white man to justify his exploitation of the Indian, a history the Indian is continually reminded of at school, on television, in books, and at the movies" (Committee on Labor and Public Welfare, 1969).

Many children, whose only contact with Native Americans is through the images they view on television and at the movies, have little else upon which to base their perceptions and beliefs relative the these peoples and their cultures. Like any other art form, film both reflects and contributes to the culture in which it exists. Films embody the values, and beliefs of society and assists in transmitting social structures and cultures to mass audiences. Consequently, many Native American stereotypes persist today because television shows and films perpetuate misconceptions. In order combat these stereotypes and promote positive images of Native Americans, children must be assisted in confronting many of the very myths and stereotypes upon which the American nation was built.

Using Images That Combat Stereotypes

Since the misuse of images in movies and on television plays so significant a role in the creation of Native American stereotypes, it seems only natural that the proper use of images can be a powerful tool for combating them. Dumas (1988) recognized the importance of this aspect of visual literacy when he reported that educated viewers often find it relatively easy to identify the intentions behind biased images. Messaris (1995) suggested that knowing about the conventional implications of certain images helps make viewers more resistant to the manipulative uses of those images and that less-educated viewers are less conscious of these intentions and may therefore be in a position to benefit substantially from anti bias instruction.

This is particularly true of younger children who are especially sensitive to pictures. Before they enter school, children have spent a good portion of their lives "reading" pictures as a prelude to their struggle to understand the spoken and written word. For most of us, our early experiences with images carries over into our continuing effort to make sense of a perplexing world.

The use of images by teachers is nothing new; visual displays such as bulletin boards or images mounted for classroom displays are commonplace. But such applications are often unbearably passive and offer students little opportunity to manipulate images or to include them in their everyday activities. Digital images, on the other hand, can easily be manipulated and incorporated in a variety of activities including the collaborative development of student web pages, slide shows and multimedia presentations.

A prime consideration for including an image in any anti bias activity should be the image's potential for provoking thoughtful discussion. Images which depict Native Americans in non-traditional ways and which can be contrasted to the stereotypical pictures so readily available are particularly useful. A photograph of a tribal chief watching television in a three-piece business suit, for example, might be contrasted to the traditional war bonnet and buckskins. Of particular usefulness are images which emphasize Native Americans engaged in common family and social activities.

When selecting images for classroom use it is important not to overemphasize the "exotic." Photographs of Native Americans found in popular media tend specialize in the bizarre and unusual and should be avoided. Images which represent Native Americans engaged in non-stereotypical activities should be emphasized instead. Modern photographs of Native Americans should be included as well as historical images.

Images and captions which make sweeping generalizations about Native Americans should also be avoided. Generic "Indian" materials usually fail to portray the tremendous diversity among Native American cultures of the past and present. More trustworthy media depict American Indians within the context of their specific nations, tribes or villages.

It is also important to avoid images which exploit Native American cultural and spiritual traditions. Such images often depict private or sacred objects such as tribal religious practices and symbols without the consent of the Native American culture that created them.

Finding sources of Native American images that are not superficial or stereotypical remains a challenge to teachers who wish to develop media-based anti bias lessons. Fortunately, the growth of the World Wide Web has made this process much simpler. A number of web sites developed and maintained by educational agencies and Native American organizations feature collections of images useful in combating stereotypes. In addition to images to be found on various tribal web sites, the Library of Congress and Utah's SURWEB web site are both excellent sources of useful images. The special collections archive of the Library of Congress includes several hundred historical photographs of Native Americans and SURWEB's image database includes over 11,000 photographs which can be searched by using keywords and phrases.

What SURWEB Has to Offer

The State of Utah Resource Web (SURWEB) is a project mounted by a consortium of public and private agencies including Utah's four educational service centers, institutions of higher learning, the Office of Educational Research and Improvement (OERI) regional educational laboratory, museums, state and national parks, and Native American tribal councils and agencies. The SURWEB project was implemented to address discrepancies in educational opportunities for Utah students who may be poor, rural, or from culturally disenfranchised communities. In addition, SURWEB was designed to provide authentic, student centered, locally created resources to enhance the educational opportunities of all of Utah's elementary and secondary students. Specifically targeted is the state's increasing Native American population, consisting primarily of Ute and Navajo people who suffer increased cultural isolation as well as physical isolation from support services. In some Utah counties, Native Americans make up more than 50% of the K-12 public school enrollment . A portion of the Navajo Reservation comprises nearly 25% of San Juan County and smaller reservations of the Goshute, Paiute and Ute mountain tribes are spread over several counties.

During SURWEB's inaugural year, integrated units with Native American content were developed for the World Wide Web. These units focus on the cultures of the Navajo, Paiute and Anasazi tribes and feature several hundred images in databases which can be accessed via the Internet. Included with the database is a powerful search engine which enables students and teachers to locate and download images related to a specific topic for classroom use. The SURWEB web site also includes a "media basket" feature which allows students and teachers to construct their own personalized slide shows by marking and recording the locations of the images and captions. Images, sound and movie files garnered from any location on the World Wide Web can easily be added to the media basket. Once collected, elements in the media basket, can be effortlessly transformed into "media shows" and viewed in the classroom or published on the Web for viewing by others.

Using Images to Develop an Anti bias Curriculum

Thanks to television, movies, and other popular media, children, especially younger ones, continue to be exposed to old, negative stereotypes of Native Americans. But as teachers become more aware of the stereotypical images and misconceptions students bring with them to the classroom, they can begin to develop an anti bias curriculum that encourages children to apply critical thinking skills to challenge the messages of biased images. It is equally important for teachers to employ these skills themselves as they begin to plan activities which attack stereotypes. Teachers must take care to avoid approaches which lead students from viewing Native Americans as savages to the opposite extreme of romanticizing them. Romanticizing Native Americans or viewing them as uniformly wise and noble is counterproductive and succeeds only in replacing one unrealistic portrayal with another.

With adequate planning, an effective anti-bias curriculum can be implemented at virtually any educational level using a wide variety of approaches and strategies. One practical technique, called webbing, helps teachers and students identify an array of possible topics for interdisciplinary learning (Derman-Sparks, 1994). Webbing involves several steps:

- • First, the center of the web, which will contain the theme to be studied, is determined. An example of a theme might be the agricultural techniques of the Paiute.

- • Step two involves brainstorming possible issues that stem from the theme at the center of the web. Examples could include indigenous dietary practices, the role of Paiute women in food production, or the connection between the cultivation of the land and resistance to colonization by the Mormon pioneers.
- • In the third step, the level of awareness of individual students relative to the topic is determined and specific anti bias issues are explored. Exercises or sets of focus questions that require students to draw from their personal knowledge of Native American stereotypes are developed and images illustrating these stereotypes are selected and used to stimulate discussion.
- • In the final step, students help brainstorm a list of activities that they will pursue to fill in the gaps in their knowledge. An interdisciplinary approach to the theme strengthens the anti bias aspects of the curriculum. In language arts, students could read a Paiute legend or conduct a study of Paiute place names. In science, students might use the Internet to research the breeds of sheep raised by members of the Paiute Nation while mathematics students could use spreadsheets to the compare relative sizes of the flocks produced by past and present generations of Paiute farmers.

SURWEB resources can be especially useful in this brainstorming process. Since the database format imposes no particular structure, students are free to explore and manipulate the information it contains in virtually any way they can imagine. As they assemble their own media baskets and shows, they can organize SURWEB's images and text in a wide variety of ways to support the open-ended activities they construct. The lesson plan which follows illustrates how an anti-bias activity might be built around the search and media show capabilities SURWEB image database.

A Sample Lesson Plan Based on SURWEB Images

Title: Recognizing Native American Stereotypes

Subjects: Social Studies, Language Arts, Computer Science, Visual Literacy

Learning Level: Intermediate

Snapshot: This lesson explores Native American stereotypes. Working collaboratively in small groups, students will identify various stereotypes and utilize computers and the World Wide Web to locate and collect images which both support and contradict these stereotypes. Collected images will be used to create a "media show" for class presentation and discussion.

Invitation: How can we help students recognize and dispel the various stereotypes of Native Americans represented in images promoted by popular media? How can we encourage them to think critically about the biases often reflected in the way American Indians are portrayed in images and on television and film? How can we help students develop the visual literacy skills essential to the critical analysis and evaluation of images?

Situations: The time required for this lesson will vary according to the experience level and technological expertise of the students. Typically, with adequate direction from the teacher, students should be able to brainstorm a topic and construct a web within a day or so. The time required to collect representative images and construct a media show will vary according the students' familiarity with computers and the World Wide Web. Time needed to master SURWEB's search and media show tools should be minimal due to the intuitive nature of the SURWEB interface. An excellent on-line tutorial is provided for first time users. The time required for presentation and discussion of the groups' media show will vary but it is vital that adequate time be allowed to view and evaluate the images. Since in-depth discussion is essential to the process of critical analysis, the goal of the teacher in this phase of the lesson should be to encourage students to talk about why they selected certain images as representative. This not only helps students develop language skills but causes them to focus on the content of the picture and the underlying messages it presents. Teachers should guide discussion and interject comments when appropriate. (For example, when I first taught this lesson with a group of fourth graders, one student referred to people in a picture sitting "Indian style" around a campfire. A quick search of the database turned up several pictures of Native Americans sitting on couches, chairs and in other non-stereotypical ways. In the discussion which ensued, students concluded that Native Americans sit in pretty much the same manner as others).

Tasks: Students will be part of a group and assigned the task of constructing a semantic web of common Native American stereotypes. Each group will then collect images which illustrate and contradict the stereotypes outlined in its web using the rich interactive tools of the SURWEB database. Once collected, the images will be used to construct a slide show for presentation in class. The stereotypes represented in the slide shows will be analyzed and discussed. Following the discussion, the groups will be asked to collaborate on a paper outlining their findings which will be published on the World Wide Web.

Interactions: Students will work in small collaborative learning groups (two or three students per group) to complete all tasks. The primary role of the teacher will be to promote discussion and to serve as facilitator for the various processes (data collection, media show development, etc.) involved in completing the assigned tasks.

Standards: This unit is consistent with the standards of the core curricula of many state and local boards of education. Broad competencies addressed in the lesson include:

1. investigating the customs, beliefs and ways of life of specific Native American cultures.
2. using computer technology and the Internet as a research tool.
3. using technology as a platform for written and visual presentations.
4. working collaboratively to produce, present and publish a report of group research findings.
5. applying critical thinking and visual literacy skills.
6. writing for specific audiences and purposes.

Assessment: Assessment will be based on teacher and peer review of written reports and media presentations. Rubrics and checklists may be developed to assess the quality of individual work in participating in group processes and contributing to group products.

Tools: Tools and resources necessary to complete the lesson include a computer with Internet access and resources available at the SURWEB web site (http://www.surweb.org). A large computer monitor, LCD projector or method of projecting student media shows is desirable but not essential. If these technologies are not available, media shows may be presented by simply printing out images and captions and mounting them on posters for classroom display.

Conclusion

Pictures alone cannot eliminate four centuries of stereotyping and cultural bias or instantly transform a classroom into a multicultural Utopia, but they can become a key element for constructing an anti bias curriculum that encourages tolerance, understanding, and respect for others. As children manipulate and analyze pictures and relate to them in positive ways which encourage open discussion and analytical thinking, they begin to understand that diversity exists everywhere and that it is a valuable dimension of the society in which we live. Once established, this understanding can provide a solid foundation upon which students and teachers can begin to build acceptance of and respect for Native American and other diverse cultures.

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The Social Impacts of Computer-Mediated Communication (CMC) on Chinese Teachers' Authority

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Abstract: This article describes how computer-mediated communication (CMC) has eroded the ancient relationship between Chinese students and their teachers. The lack of non-verbal cues and other characteristics of CMC have impacted both Eastern and Western classrooms. The reality of online flaming is analyzed from the socio-psychological and cognitive aspects; i.e., why flaming happens. What are the impacts on Chinese teachers' authority? How should educators and students work against these flaming incidents? It is suggested that The Chinese teacher's role needs to be redefined. Absolute teacher authority should be eschewed. Students should be encouraged to express their opinions.

The pervasiveness of computer-mediated communication (CMC) in education has threatened Chinese teachers' authority with online flaming. Chinese students have respected their teachers, and the education they provide, for more than 3,000 years. Teachers have exercised absolute authority in the traditional Chinese classroom. Chinese students have regarded their teachers as omniscient. An old Chinese proverb states, "A teacher for a day is a father for life." The Chinese culture perceives deference to authority as upright, prudent, and beneficial to the society. Quietness and respect for superiors, such as teachers, is considered an important value (Sitaram & Cogdell, 1976). The same respect for authority would be viewed as weak, cowardly and unprincipled in a more democratic society (Bond, 1991). Students are permitted to express their opinions only when those opinions are proper. Expressions that demean the teacher are considered offensive.

Flaming

Flaming, asserted to be an antisocial effect of CMC, is considered to be an uninhibited behavior of CMC users, it consists of the exchange of emotionally charged, hostile and insulting messages (Thompson, 1993). Several definitions can be found in the CMC literature (Baron, 1984; Lea, O'Shea, Fung, & Spears, 1992; Walther, 1992). Lea et al. (1992) have noted that flaming has not been consistently operationalized in past research. Thompson (1993) proposed four weaknesses of previous definitions of flaming: (1) time ignorance, (2) bias toward to face-to-face communication, (3) meaning realism, and (4) deterministic assumptions on CMC. He argued that behavioral and interpretive dimensions should be considered as defining flaming. He projected a "social influence model of flaming" which originated as a "social information progress model" (Fulk, Steinfield, Schmitz, & Power, 1987). According to the social influence model of flaming, human behavior while using computer technology is determined subjectively by the users, not objectively. A definition of flaming generated from this perspective: flaming refers to computer-mediated communication behaviors that are interpreted as inappropriately hostile (Thompson, 1993).

From any perspective, flaming in academic settings can be identified in certain types of student behavior, including impoliteness, swearing, charged outbursts, and an excessive use of superlatives (Hawisher, 1992). The idea of the classroom and academic setting as a nonflammable area is desirable to instructors. However, CMC is threatening the Chinese tradition of respect for teachers. Research has demonstrated that "individuals in a low culture context (LCC) are more likely to assume a confrontational, direct attitude toward conflicts," and those "in an high culture context (HCC) are more likely assume a non-confrontational, indirect attitude toward conflicts" (Ting-Toomey, 1985). Several flaming incidents have occurred on college campuses in Taiwan, Republic of China. These flaming incidents are a direct challenge of the Chinese teachers' authority by students.

Flaming Incident 1

In 1995, postings on the BBS at National Taiwan University besmirched the reputations of five instructors in the engineering department. Over the course of two months, fake confessions from these instructors appeared in which they "admitted" to being irresponsible teachers and "confessed" to all sorts of vile acts that they had supposedly committed in classrooms and offices. The department reported the incidents to the police whose investigation revealed that the prank was being carried our by two graduates of the department. The instructors asked students to make public apology, and in exchange dropped a libel suit.

Flaming Incident 2

The "electric motorcycle incident" rocked the campus of National Tsing Hua University in 1995. It resulted in a law suite involving 13 students and a souring of student-faculty relations. The university administration banned gasoline-powered motorcycles on campus for environmental reasons and non-polluting "electric motorcycles" were promoted. Professor Chou, who had designed an electric motorcycle, had participated in the decision to ban motorcycles from campus. When a notice promoting the $ 1,000 bikes was posted on the BBS the students responded. They covered the campus with posters, and posted messages on line, accusing Professor Chou of taking advantage of the situation by promoting the dealers of electric motorcycles that he had designed. Chou held that students were committing libel, and he sued the 13 students who had signed their names to the posters. These students collected information and posted it to a home page devoted to their defense. The information resulted in Chou's unconditional withdrawal of the lawsuit.

Analysis from the Perspective of Characteristics of CMC

Uninhibited behavior exhibited in an online environment is caused by CMC inability e to delivery the social context cues which are available in the face-to-face environment (Walther, 1992). Several characteristics of CMC related to inhibited behavior are discussed below:

Anonymity and Multiple Identities

One can have anonymity and multiple identities in "cyberspace" and one can shift identities rather easily, taking on characteristics of others' identities (Jones, 1995). De-individuation occurs when people have anonymity or when situation lacks societal mores and values (Sproull & Kiesler, 1991). On-line users are able to create multiple identities (real and pseudo) to socialize with different persons on the line at the same time. This characteristic reduces the user's self-awareness and allows uninhibited behavior (Lea & Spears, 1991; Sproull & Kiesler, 1991). Many CMC users erroneously conceive of themselves as being "invisible."

Lack of Social Context Cues and Social Presence Theory

In CMC, the absence of social context cues contributes to uninhibited behavior (Kiesler, Siegel, & McGuire, 1984; Siegel, Dubrovsky, & McGuire, 1986). From the social presence theory (Short, Williams, & Christie , 1976) perspective, CMC is considered as a low social presence medium (Walther, 1992) because of its inability to transmit the others' presence and social context cues. It causes impersonal communication. However Gunawardena (1995 & 1997) and Tu (1997) concluded that by asking CMC users to rate the level of social presence, CMC was rated by users as social medium.

Information Richness Theory

Richness theory holds that media vary in richness of information (Daft & Lengel, 1986). CMC is considered as a lean medium due to its inability to transmit rich information. Generally speaking, face-to-face communication is touted as the richest medium, given the availability of immediate feedback, the number of cues and channels utilized, nonverbal backchanneling cues, and personalization and language variety. Other media, such as videoconferencing and telephone, are described as moderately rich according to their channel capacities. Formal letters and memoranda are the leanest. CMC is a very lean channel, because nonverbal cues are absent. However, experienced computer users rated several text-based media (including e-mail and computer conferencing) as "richer" media than telephone conversations, television, and face-to-face conversation (Foulger, 1990).

Lack of Social Norms and On-line Etiquette

There are few norms governing the use of CMC related to flaming. Etiquette is still unclear to most on-line users. Educators are striving to articulate the etiquette and rules to govern on-line behavior. On-line etiquette is immature. There is no consensus regarding on-line etiquette although many groups are searching for one. Without a social norm, on-line users have found that it's very easy to exit the boundaries.

On-line Community

The fact is that the social standard is less important, and more impersonal, polarizes members of a group (Kiesler, 1984). In an on-line community whose members are discontented, and are in conflict with one another, impersonal behavior might tends to polarize members, exacerbate aggressiveness, and cause negative attributions to others (Walther, 1992). According to Gunawardena's (1995) and Tu's (1997) studies; however, an on-line community that is on friendly, cooperative terms, impersonal behavior might actually encourage joint approaches to the decision making or negotiating, and it could reduce self-consciousness and promote intimacy. Students are more often willing to approach a professor for assistance with assignments through electronic mail than in a face-to-face encounter (Tu, 1997).

Interpretive and Behavioral Dimension

From the interpretive dimension, two components of social influence model were identified: media use and media evaluation (Thompson, 1993). Flaming as media use is a function of (a) media evaluations, (b) media experience and skills, (c) social influence, (d) task evaluations, and (e) situational factors. Flaming, as media evaluation is a function of (a) media features, (b) media experience and skills, (c) social influence, and (d) prior media-use behavior (Fulk et al., 1990).

Media Use

From the characteristics of media standpoint, a number of studies have concluded the causes of the flaming. Siegel et al. (1986) found that flaming is related anxiety and feelings of frustration in learning to use CMC. The second interpretation is task evaluation. In different settings, CMC is perceived for different tasks. For example, if CMC is perceived as an important medium to deliver messages, and flaming may be discouraged as an inappropriate waste of resources (Foulger, 1990). Situational factors are very crucial to examine. Time and location may influence flaming. Asynchronous CMC is a significant factor in flaming as well as a casual location. Robinson-Stavely and Cooper (1990) argued that the presence of others influence CMC behavior which can be explained by that online users see others visible; however, they see themselves invisible.

Media Evaluation

Hardware and software can be factors that influence flaming. For example, how user-friendly of an e-mail or discussion system is, how fast the modem can transfer the messages, or the ease of configuring the hardware and software. The interpretation of flaming from previous experience may influence evaluation of CMC behavior.

There is evidence that pre-usage expectations of media use influence media evaluation (Rice, Grant, Schmitz, & Torobin, 1990).

Different levels of media experience and skill influence both flaming as behavior and flaming as in interpretive sense-making (Thompson, 1993). Goode and Johnson (1991) found that more experienced CMC users are likely to be more aware of proper behavior than novice users and are less likely to resort to flaming. Fulk et al. (1990) proposed four types of social influence: (1) direct statements by others (Thompson, 1992), (2) vicarious learning, (3) group behavioral norms, and (4) people who rate CMC as an inadequate or inappropriate expression of emotion are less like to craft flaming messages.

Impact on Chinese Students

The distinctions that have determined relationships for centuries are erased. This is true of the hierarchical structures that have determined the relationships between teachers and students. CMC provides Chinese students a comfort zone where they can chat openly, even anonymously by creating a pseudo-identity. Due to losing the fear of social approbation, CMC users imagine they must use stronger language to get their messages across (Sproull & Kiesler, 1991). While composing the messages, without tangible reminders (social cues) and other's physically present, on-line Chinese students were easy to forget the norms to communicate the others, and become extreme and impulsive. Therefore, the student may feel that the traditional Chinese constraints do not apply to CMC. Conversely, on-line messages are very public, they are seen throughout the world. Security remains a major concern for most on-line users.

As long as students regard the on-line community as a safe zone, where opinions can be expressed openly, they can use the tool of language as a weapon (George, 1990; Rich, 1979). Students who have been culturally programmed and dis-empowered for so long have a great deal of trouble knowing what to do with power once it is given to them (George, 1990). Chinese students, who have never been in free talk zone, find themselves in such an area without an etiquette that enables them to use this power properly.

Teachers fear the loss of their authority and the pressure of public opinion. A flaming further threatens the teacher's position and challenges their traditional place of respect.

Solution

The Chinese teacher's role needs to be redefined. Absolute teacher authority should be eschewed. Students should be encouraged to express their opinions. Teachers should provide education to students about this powerful medium, so they can utilize CMC as a learning and positive communication tool. Chinese teachers and students should reach an agreement about on-line communication. On-line behavior should be regulated based on traditional Chinese ethics. Senders of messages should assume that any message sent is permanent; have in mind a model of the intended audience; do not insult or criticize third parties without giving them a change to respond. It also offers advice for recipients: avoid responding while emotional; assume the honesty and competence of the sender; avoid irrelevancies.

Conclusion

Computer-mediated communication (CMC) provides an excellent opportunity for Chinese students to express their thoughts and opinions. A recent pilot study was conducted using quantitative and qualitative methods, revealed positive thought that Chinese students perceive CMC as a sociable media (Tu, 1998 & 1999). It is concluded that Chinese teachers' roles should be redefined. Chinese teachers should allow their authority to be challenged.

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Literacy Development and Learning Through Knowledge Building Technology in Canada's Eastern Arctic: Educators' Perspectives

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Abstract: Some educators in Canada's Eastern Arctic are currently part of of a project involving a knowledge-building computer software program, CSILE/Knowledge Forum. Over the course of the last five years, the software has been adopted in several northern schools. As a teacher involved in the implementation of the use of the software, I became interested in how the software enhanced knowledge building. Further, although literacy development is not an implicit aim of CSILE / Knowledge Forum, I became interested in how the use of the software impacts on the literacy learning of Inuit upper elementary students, learning in their second language of English. Interviews have been conducted. This paper reports on preliminary findings in a more extensive study which suggests that educators view a positive relationship between use of CSILE/Knowledge Forum, knowledge building and literacy development for Inuit children.

Contextual Framework

For Inuit in the Eastern Arctic, change has become a way of life in the last half a century as they moved from being primarily nomadic to living in coastal communities. They have also made the transition from being an oral culture to one that values both oral and written communication. In recent times, change in communication styles has been accelerated due to advances in technology. Although there is widespread recognition that the culture of the Inuit and their predecessors predates all others in the North, there is the potential danger that their culture will be supplanted by others as technology widens its impact.The computer, as the means of communicating with the rest of the world, is a symbol of other cultures that are changing the North. With the emergence of computer technology and the use of software such as Knowledge Forum, the community can potentially communicate, share and build, in a positive manner, the knowledge of multiple cultures. In classrooms in Iqaluit, computers are beginning to represent a communication link to the past, via the present, to the future.

Iqaluit, Northwest Territories, is an isolated community of approximately 4300 people that is poised to become the capital of Nunavut, Canada's third territory, on April 1, 1999. It is a community where 85 % of the students are Inuit, who are a unique blend of traditional and modern ways of living. It has been said that Inuit have come from the Stone Age to the Computer Age in one generation. The dramatic change in generational experiences of the Inuit is evident during parent orientations when students share their collaborated research database on the history, government and resources of the North with some members of their families who had been born out on the land, often in igloos, with little or no formal schooling.

With the rapidly advancing official creation of Canada's newest territory comes a desire to ensure that Inuit students in the Eastern Arctic are prepared for a global society, in spite of the many obstacles they face in these times of rapid change. In the North, with so many official languages, and regional dialects for many of these languages, maintaining aboriginal languages is itself a constant struggle, particularly in the presence of the more dominant world languages of English and French. The increasing prevalence of the media, where English is the dominant language, further compounds the issue, contributing to literacy challenges. "literacy levels remain the lowest in Canada - 36 percent of... population have less than a Grade 9 education and although ... high school graduation rate is increasing, it stands at approximately 35 per cent" (Kusugak,1998, p.1). In Iqaluit, grades four to six are transition years for Inuit students as they move from being taught in their first language of Inuktitut to being

taught predominantly in English. It is vital during these transitions years to respect, support and build on students' first language and culture while developing competence in English literacy.

Given the motivational factor of computers for youth (Papert,1993), and literacy concerns in the North, one of the challenges for educators becomes, how do we make the computer learning experiences of our students culturally relevant while ensuring that they enhance their literacy development and learning? The potential exists through the use of a collaborative knowledge building software program originally known as Computer Supported Intentional Learning Environment (CSILE), released commercially in 1996 as Knowledge Forum. (Scardamalia et al., 1987).

CSILE / Knowledge Forum is a unique computer software program whereby students, educators and other experts contribute text and graphic notes to a public database through a collaborative construction of knowledge. Participants explore specific areas of interest under the umbrella topics introduced, utilizing a scientific method approach of devising a problem, developing theories, posing additional questions, planning, researching new information from a variety of sources, representing new learning through text and graphics, devising a better theory, etc. or through focused discussion topics. Topics can be tailored to meet the specific local curricula and interests/needs of the students, as each site starts with an empty database on their server. Students, educators and external resource people contribute to the database on client computers to construct knowledge as a community. This allows for continual modification, building on each other's ideas, constructing knowledge whether individually or in groups. In a northern setting, where many students are learning in their second language, with very limited written resources in their first language of Inuktitut, this has enabled many to benefit from information that is culturally relevant and locally developed, as a possible springboard to expanding their ideas on a more global level.

The CSILE / Knowledge Forum program was designed originally as a way to encourage thinking and to study how thoughts are processed and reprocessed(Scardamalia et al., 1987). Through participation in the CSILE / Knowledge Forum project an interesting issue has arisen. While the program was designed to enhance knowledge building, it would appear that literacy learning has the potential to be enhanced. Little has been written on the impact of technological software for Inuit children who are learning English as a second language. More specifically, the effect of Knowledge Forum on literacy development and learning for Inuit children has not been researched. Educators who work closely with the Inuit children are in a position to reflect critically on the impact of the software on the learning and literacy development of the children. This research therefore explores the question: What do educators view as the impact of the knowledge building technology of Knowledge Forum on the learning and literacy development of Inuit youth learning English as a Second Language in elementary schools in Iqaluit, NT? More specifically: How is technology perceived in northern classroom settings? How is knowledge constructed? What role does Knowledge Forum play in northern classroom settings? What is meant by the term 'literacy'? How do multicultural literacies differ from traditional views of literacy? What are the perceived relationships between literacy and knowledge building? How does Knowledge Forum enhance multicultural literacies?

Theoretical Perspectives

Given that the Inuit culture has been an oral culture for centuries, traditional definitions of literacy as based on abilities to read and write, imply that Inuit could be considered illiterate before a written form of their language was recorded. This can be disputed when one broadens the definition to include reading more than just alphabaic words. As one participant, George, notes, literacy is "being able enter into a dialogue with the world, and, for most of western society, that dialogue involves understanding and relating to print, and communicating through print. ... Literacy in the traditional Inuit world, involves being able to read the weather, the land, animal tracks, and those kinds of things." An understanding of literacy through knowledge building thus needs to begin with an overview of perspectives in these two areas.

Literacy

"Literacy is a two-edged sword. It can be repressive or liberating." (Hoyles, 1977, p.29)

Initial perceptions of literacy as an indication of reading and writing skills are countered by the work of Kale and Luke (1991) who explore the "social nature and cultural implications of the multiple and varying routes to

literacy" (p.3). As a result of revisions to definitions of literacy over the years, there is growing recognition that literacy levels are "arbitrary and fluctuating" (McDonagh, 1993, p. 219). The information needs of a society dictate the current definition for literacy. (Niederhauser, 1997).

Ross and Bailey identify four historical literacy eras which reflect on societal information needs - "pictographic, oral, bibliographic and electrographic" (Niederhauser, 1997, p. 1). Although the time frameworks are different from the rest of the world, for Inuit these eras are pertinent. The pictographic era, with the focus on pictures and monuments, could be exemplified by the use of inuksuks, which are carefully constructed rock pile formations 'in likeness of man', as signals of directions to travel. For Inuit, the pictographic literacy era coincides with the era of oral literacy. The Inuit are well known for their oral traditions, with storytelling, throat singing etc. being utilized as means of "giving children the knowledge, skills, beliefs and values necessary for social, economic and political survival in society." (Maina, 1997, p.296). In an oral culture, a person and their words could not be separated. For Inuit, the bibliographic era of literacy began with the coming of the Qallunaat (non-Inuit), whether they were missionaries, whalers, government personnel or traders. Indeed the missionaries are credited with adopting the syllabics of the Cree to form the written symbols of Inuktitut, the language of the Inuit. With the permeation of technology in the North, the electrographic literacy era is well underway in the North.

Literacy is indeed a complex entity, that entails far more than just reading and writing (Winterowd,1989, Hirsch, 1983, Saravia-Shore & Arvizu, 1992), with growing recognition of the broader societal implications for literacy levels. The critical component of literacy has been explored by many, including Hunsberger, Bailey and Hayden(1998) who note that although educated people assume literacy is desirable, necessary and empowering, there are many issues that 'literacy' raises that may not always be so desirable.The whole issue of literacy as a means of empowerment has been explored most extensively by Paulo Freire (1971, 1985), with his literacy programs for oppressed people in Brazil. Raising political consciousness, Freire felt, was the means of motivating people to become more literate and thus empowered. For Inuit students, with the history of Eurocentric domination and the future offered with the creation of Nunavut, the multifaceted nature of literacy offers the potential of liberation from past practices, especially as the cultural elements of literacy are understood. (Delpit, 1988, Mitiche, 1993, Diamond & Moore,1995). The word "multiliteracies" becomes more appropriate as it reflects the complexity and plural nature of this concept.

Knowledge Building Technology

"(T)hinking about the computer's role in education does not mean thinking about computers; it means thinking about education." (Ellis, 1974, p.42)

In 1992, Bereiter and Scardamalia utilized the term 'knowledge-building communities' to represent their constructivist model for learning that was distinguished from other approaches by its very nature. "What is defining about a Knowledge - Building Community is ... a commitment among its members to invest their resources in the collective upgrading of knowledge" (Hewitt & Scardamalia, 1998, p. 82). Characteristics of knowledge-building communities include sustained, in-depth study of topics; focus on problem solving rather than acquisition of facts; student driven inquiries; student production of theories and critiques; collective understanding of topics; small group cooperation; discourse based; and the teacher as learner along with the students (Bereiter & Scardamalia, 1993, pp.210-211). Bereiter and Scardamalia note that "[T]he focus of activity is on acquiring new knowledge, synthesizing it with existing information, detecting gaps in understanding, constructing explanations, and so on. Developing understanding becomes an objective of the student, and knowledge becomes an object of inquiry." (Hewitt et al., 1994, p.1) Such a shift in educational focus, requires a reconceptualization of the purposes of education for our youth today. (Salamon, 1992) Given the cautions that abound about use of computers in education (Papert, 1974, Ellis, 1974, Armstrong & Casement, 1998) Hewitt and Scardamalia recommend a "careful interweaving of computer supports and new educational practices" (p.94) in order to foster a classroom based knowledge-building community.

In order for effective learning environments utilizing computers to materialize, there needs to be an understanding of the impact culture and context have on the construction of knowledge. Knowledge in the northern classroom environment is enhanced thorough the students' cultural context, assisting in the development of knowledge-building communities.

The construction of knowledge, or knowledge-building, potentially can become empowering for the students as "when students are given the opportunity to co-create their own knowledge base, they will be more likely to accept responsibility for claiming, and actively participating in, their own educational experience" (Carr et

al., p. 12) Such changes in approach within the educational system, particularly through knowledge-building technology, will necessitate dynamic reviews of the aims and values in education. "As society is altered by the presence of the computer, education ... must reexamine and refashion its educational goals." (Ellis, 1974, p. 57)

The Study

With the understanding of the importance of context in any situation, those best able to articulate the impact on literacy development and learning are those educators who use the knowledge-building technology of Knowledge Forum in Iqaluit. Having taught in the North for ten years, and as a member of the Baffin CSILE / Knowledge Forum Team for the last five years, I endeavoured to solicit input from a representative cross-section of our group. Thus the educators from two Iqaluit elementary schools are the participants in this ongoing research, representing first-, second- and multiple-year users of CSILE/Knowledge Forum, Inuit and non-Inuit, classroom support assistants, teachers, administrators and consultants. Initial semi-structured interviews were conducted with participants to identify beginning thoughts and understandings, in the sense of how they interpret and apply meaning to the experiences of these members of our CSILE / Knowledge Forum team. As Vygotsky notes, "Every word that people use in telling their stories is a microcosm of their consciousness." (Seidman, 1991, p. 1) Given the physical distances involved, interviews were conducted through the participants' choice of phone / E-mail / fax. They were then transcribed. In addition, over the course of the year, these educators are participating in the Classroom Research Journal on their school based Knowledge Forum database, in the form of knowledge building notes around concepts such as the impact of Knowledge Forum, observations, questions and comments.This database is accessible initially through Apple Remote Access, converting to Internet access as the technology is finalized in the Iqaluit classrooms. The educators involved will be interviewed later in the spring to see if their perceptions have changed. Analysis is ongoing.

Educators' Perspectives

Technology

Participants' prior experiences with technology ranged, where, for the most part, the terminology of 'technology' is seen to be synonymous with 'computers'. Common uses of the computer include as a word processor, or for drills and games. Brian has experience with Computer Assisted Instruction and graphical communication with adults. Another participant, George, has been involved for years in providing workshops on desktop publishing software, telecommunications and CSILE / Knowledge Forum.

Given the range of prior experiences, it is not surprising that participants also differ in their perceptions of the role of technology in northern elementary classrooms. As Brian comments, "The role now is very limited, but the role can be very extensive..(It) offers tremendous possibilities." The dominant themes for such a technological role are as a tool for research and as a means of connecting and communicating with others. George stresses the significance of the computer as a means to explore and enhance Aboriginal languages and cultures. He also feels that technology can be beneficial to educators as it enables interclassroom linkages and professional growth. Several participants feel that the current expansion of Internet in the schools provides even further opportunities for research for students who have had access to relatively few resource materials written at levels they can comprehend in their second language. Mary furthers this with her comments about technology as playing "a very important and powerful role... , in this era of technology. Internet just opens up the door to the world and learning, ... I think it should be a must in all classrooms in the North, especially because of our isolation."

Knowledge Building

The knowledge building software of CSILE / Knowledge Forum has been used by participants to varying degrees, whether in student, classroom teacher, classroom support assistant, administrator or consultant roles. Knowledge building, as the terminology suggests, is "taking what you know and building on it" (Dale). Ingkhar expands on this notion by recognizing knowledge-building as going beyond the individual role, to include putting knowledge together with others. This more pluralistic responsibility for building knowledge is reinforced by George, who notes "Knowledge is a social construct and we build it up through engaging ourselves with the world

and with other people in an effort to understand something, so that one level of understanding leads to deeper questions, further investigation, further testing of that understanding, deeper levels of understanding and more sophisticated questions." There is general consensus among participants that knowledge building implies more than just acquisition of facts, and that the students have greater say in the direction they will go.

Literacy Learning

The views of educators who were participants was representative of many in our world. Primarily, they viewed literacy as reading and writing. When questioned what literacy was in traditional Inuit culture, answers were thought-provoking. When questioned regarding the oral tradition for Inuit, participants were prompted to expand their initial conceptions about literacy. Ingkhar recognized the ability to be literate in the arts, with the wealth of information also shared traditionally through verbal interchanges, storytelling and throat singing. Mary broadened her perceptions of literacy to include being knowledgeable in different cultures and how they learn. In the case of the Inuit, much of the knowledge was passed on through observations of elders. Brian noted the necessary expansion of literacy given the demands of computer usage. All stressed the importance of communication in defining literacy.

Educators in this study generally viewed the relationship between literacy levels and Knowledge Forum as positive. Several participants comment on the motivation apparently intrinsic to computers. Brian is impressed with the growth, in terms of increased content and willingness to use the computer as a means of communicating, he saw in students who have used CSILE / Knowledge Forum for an extended period of time. Mary concurs, adding that she has witnessed students supporting each other, cooperating on activities and editing, more willing to read and share their work with others. George, as the participant who has been involved in the Baffin CSILE / Knowledge Forum project for years, possesses the more comprehensive overview of the relationship amongst these three categories. "Knowledge Forum is a highly literate environment so if the students are using ... (it) appropriately, their literacy skills are bound to grow. ... (T)hey (are) learn(ing) a different kind of literacy... an understanding .. of dialoguing that says the written language is a medium for learning, ... showing them that their use of the printed word has a role in helping them move towards a better understanding about issues in the world."

Concluding Comments

The nature of the CSILE / Knowledge Forum software appears to enable educators to be active participants, with students and with each other, in building new understandings for "real purposes" (George, Mary). The initial reflections by a variety of northern educators point to " the importance of thinking about literacy and about the consequences of literacy in fundamentally new ways, ... as intimately related to broader social and cultural practices" (Moll, 1994, p. 201).

As this research continues, it will be interesting to see educators, as learners, facilitators and teachers, building their individual and collective knowledge collaboratively through use of the software that they are utilizing with their students. Through this reflective process, these educators in Canada's Eastern Arctic have the potential to assist us in understanding the impact technologies such as CSILE / Knowledge Forum have on learning, literacy development and culture for Inuit elementary students in Canada's Eastern Arctic.

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A Comparative Study of Student Teachers' Computer Use During the Practicum

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Abstract: This study compared students teachers' computer use in two universities. Teacher education in the two universities took a different approach in providing computer training to preservice teachers. One offered a stand-alone computer training core course. The other integrated computer training into methods courses. The result revealed that student teachers' computer use was limited in both universities. The author discussed the implication of the result and various ways of computer integration in teacher education programs.

Literature Review

Ever since the introduction of microcomputers into schools, teacher education has faced the challenge of preparing preservice teachers for successful integration of the computer into teaching practice. "An essential part of integrating technology into the educational curriculum is the training of persons who will ultimately use the technology" (Byrum & Cashmen, 1993; p. 259-260).

In response to this challenge, teacher education started to offer computer literacy courses. The goals of these courses were to provide preservice teachers with necessary computer skills and foster their positive attitudes towards computers. Most preservice teachers entered the college with no or limited computer experience and negative feelings towards computers (Summers, 1988; 1990).

These computer literacy courses had positive influence upon preservice teachers' computer experience and attitudes (Reed & Overbaugh, 1993; Savenye, 1992). This course model, however, was under the question when research showed that newly graduates who received computer training in teacher education programs were not more likely to use computers than those who had not. These studies focused on beginning teachers to evaluate their computer training in teacher education program (Novak & Knowles, 1991; Olive, 1994; p. 86). "The majority of beginning teachers were found to be making little use of computers" (Olive, 1994; p. 86). When they did use computers, there was "little evidence, however, that the teachers selected programs which provided relevant practice for the students. Many of the programs they used demonstrated weak instructional design and were only remotely related to the existing curriculum" (Novak & Knowles, 1991; p. 48).

A number of researchers studied student teachers' computer use as an alternative way to assess teacher education computer training programs. These studies produced similar results (Diem, 1989; Dunn & Ridgway, 1991a; 1991b; Downes, 1993). "The students, within this study, had, seemingly, mastered the necessary 'technical' expertise that would enable them to pass written and oral queries focusing on computer hardware and software.... they had difficulties developing classroom activities" (Diem, 1989; p. 35).

The computer literacy course was then criticized as a poor "tell and show" model of practice which offered isolated and discreet computer skills, but provided little opportunity for preservice teachers to explore the computer use in real classroom settings (Byrum & Cashman, 1993; Callister & Burbules, 1990; Robinson, 1993). It was argued that computers should be used in other educational courses, not merely in computer training courses, so that preservice teachers can embrace a broad range of computer applications and develop concepts of integrating computers into the curriculum. "Preservice teachers are receiving little exposure to the computers' role in education outside of technology courses....the uses of computers for teaching and learning should be modeled by all faculty, particularly those who teach in schools of education" (Byrum & Cashman, 1993; p. 269).

However, this approach was not without problems. Faculty usually felt they neither had time nor expertise to model the computer use in their courses. Handler's study showed that computers received very limited use in teaching methods courses (1993). Preservice teachers mostly used word processing to complete assignments. Some reported to have experiences with software evaluation. "In the descriptions of the ways in which the computer was used in classes, there was very infrequent mention of it being used directly for instruction" (Handler, 1993; p. 150).

Vagel (1995) conducted a study on how the computer was being integrated into teaching methods courses in thirty-six exemplary institutions. These exemplary institutions were selected by a nominating committee for their service of providing instructional technology training to preservice teachers. All the exemplary institutions indicated they integrated the computer in the delivery of instruction in teaching methods courses, "but upon closer examination, the range of technologies employed are very limited" (Vagle, 1995; p. 244). Word processing was rated highest. CAI software was the second. The use of other types of software was extremely low such as desktop publishing, hypermedia and presentation software. Some applications were not used at all.

This study found it difficult for instructors of methods courses to develop expertise in technology use since they needed to "maintain a high level of expertise in their content fields" (Vagle, 1995; p. 242). These faculty indicated that they needed assistance from instructional technology experts in incorporating technology in the delivery of instruction.

A number of institutions have adopted team teaching approach. The idea of team teaching was that faculty could form a cooperative team in course offering. For example, faculty of methods courses could collaborate with faculty of instructional technology, utilizing each other's expertise in designing and teaching courses.

Handler (1993) described the opportunities offered to the faculty of teaching methods courses in his institution. The faculty of the Computer Education Department assisted their colleagues who were not competent computer users to develop lesson plans and co-taught methods courses. Handler predicted that this type of team work would better prepare the future teachers in the use of instructional technology.

This study compared student teachers' computer use during the practicum in two universities. Teacher education in the two universities took a different approach in providing instructional technology training to preservice teachers. One university offered a stand-alone instructional technology course. The other university integrated instructional technology into methods courses. This study focused on the manner and frequency of the computer use by student teachers during the practicum, student teachers' perception of their training adequacy, student teachers' attitudes towards the use of computers in teaching, and factors influencing student teachers' computer use.

Settings

One university was located on Guam, a U.S. territory in the West Pacific Rim . To assess the effectiveness of instructional technology (IT) training program, a study was conducted to investigate the student teachers' computer use during the practicum (Wang & Holthaus, in press). The study pointed to the need to restructure the IT program. In search for an ideal model of providing instructional technology experience to preservice teachers, another university from the U.S. mainland was selected for its alternative approach in IT training.

At the University of Guam, elementary education majors were required to take a three-credit computers in education course. The course taught computer literacy as well as classroom applications of educational software and tool software. The course was an option for secondary education majors. Students completed all the course work before they started a semester-long teaching practicum.

At the U.S. mainland university, instructional technology was integrated into elementary and secondary teaching methods courses. For example, a team of four faculty co-taught a seven-credit elementary integrated methods course which included methods of science (2 credits), mathematics (2 credits), social studies (2

credits), and instructional technology (1 credit). Students had the option of taking computer literacy courses as electives from other departments such as business, computer science, or library media.

Methodology

The total sample population for this study was 120 student teachers with 74 from the university in Guam and 46 from the U.S. mainland university. A questionnaire was developed containing 23 questions with a range of yes/no, multiple choice and Likert-type questions. One hundred and ten questionnaires were collected with the response rate of 100% from the university in Guam and 86% from the U.S. mainland university.

Findings

The results of the study were summarized in the following six tables. Background information is included in Table 1. Table 2 presents computing environment in practicum schools. Table 3, Table 4 and Table 5 summarize student teachers' comptuer use during the practicum. Table 6 compares student teachers' attitudes toward computer's role in teaching and their perception of computer training adequacy in teacher education programs.

	GUAM	**U. S.**
	%(n) Total N=64	%(n) Total N=46
Gender		
Male	20% (13)	20% (9)
Female	80% (51)	80% (37)
Age		
20-25	64% (41)	76% (35)
26-30	19% (12)	11% (5)
31-35	5% (3)	4% (2)
over 35	12% (8)	9% (4)
University Computer Courses Taken		
None	16% (10)	28% (13)
One	45% (29)	48% (22)
Two	19% (12)	13% (6)
Over Three	20% 13)	11% (5)
Types of Practicum Schools		
Elementary	70% (45)	59% (27)
Middle	5% (3)	4% (2)
High	25% (16)	20% (9)
Others		5% (8)

Table 1: Background Information

	GUAM	**U. S.**
	% (n) **N=64**	% (n) **N=46**
Computers Placement		
one computer shared between classroom	5% (3)	9% (4)
one computer in each classroom	3% (2)	57% (26)
computers in a lab	78% (50)	41% (19)
combination of above	11% (7)	28% (13)
Supervising Teachers' Computer Use		

Yes	41% (26)	76% (35)
No	59% (38)	24% (11)
Other Teachers' Computer Use		
Yes	75% (48)	93% (43)
No	25% (16)	7% (3)

Table 2: Computing Environment in Practicum Schools

	GUAM	**U. S.**
	% (n) Total N=64	% (n) Total N=46
Computer Use While Student Teaching		
Yes	81% (50)	83% (38)
No	19% (12)	17% (8)
Frequency of Computer Use		
1-5 times	19% (11)	17% (7)
6-10 times	13% (7)	25% (10)
More than 10 times	68% (37)	58% (23)
Pattern of Computer Use		
personal use	34% (18)	27% (11)
used with children	21% (11)	15% (6)
used both personal and with children	45% (24)	58% (23)

Table 3: Computer Use during the Teaching Practicum

Rank	**Guam**	**Rank**	**U. S.**
1	drill and practice (53%)	1	game (57%)
2	tutorial (27%)	2	drill and practice (46%)
3	problem solving (27%)	3	problem solving (39%)
4	game (16%)	4	tutorial (27%)
5	simulation (13%)	5	simulation (20%)

Table 4: Types of CAI Software Used during the Practicum

Rank	**Guam**	**Rank**	**U. S.**
1	word processing (66%)	1	word processing (70%)
2	graphics (31%)	2	graphics (44%)
3	spreadsheet (14%)	3	multimedia authoring (24%)
4	telecommunication (9%)	4	database (17%)
5	database (6%)	5	spreadsheet (13%)
6	multimedia authoring (5%)	5	telecommunication (13%)

Table 5: Types of Tool Software Used during the Practicum

	Guam		**U. S.**	
	Mean	**SD**	**Mean**	**SD**
Importance of Computers in Teaching	2.95	.87	2.67	.90
Teaching Effectiveness and Computer Use	3.27	.75	3.26	.71
Being Prepared for Computer Use	3.32	.53	3.20	.70
Possibility of Computer Use in the Future Teaching	3.43	.76	3.41	.72

Table 6: Student Teachers' Attitudes and Perceptions

Discussion

This study found out that student teachers in the U.S. mainland university performed better in the computer use than those on Guam. Yet, their computer use was limited. A little more than half of student teachers (58%) used the computer both personally and with children . The use of word processing was rated highest. There was a sharp drop in the use of other tool software such as graphics, database, spreadsheet, telecommunication, and multimedia authoring. Student teachers' use of CAI software revealed a similar pattern. Game and drill software were the most commonly used. The use dropped with other types of CAI software.

Student teachers in the U.S. mainland university were exposed to the computer use in integrated methods courses, which was considered as an ideal model in providing computer training to preservice teachers. What accounted for this low and limited computer use?

A closer look at the integrated methods course syllabus revealed an inadequate computer use being covered. This was one-credit course for media integration. Due to the limited time, the use of some major computer tools were not included, for instance, multimedia authoring. The course taught basic instructional design theory, software evaluation, use of a computer writing program, the Internet, and computer graphs. This was too much for a one-credit course. There was no room left for in-depth exploration of each area. For example, the Internet assignment for this course was to locate a lesson plan and e-mail it to the instructor. The Internet use was not modeled as a powerful learning tool to help school students learn subject matters and develop their higher order thinking skills.

The findings of the study showed that integrated courses can not be glued together simply by course syllabi. "Preparation of teachers to teach in an interdisciplinary manner requires taking down the barriers erected between departments. This requires a willingness for communication, collaboration, and the abandonment of the safe haven of subject-matter expertise...." (Mason, 1996; p. 267). The ultimate goal of integrated courses is not to maintain the status quo of faculty in their own expertise domain. It should be taken as an opportunity for professional development. Faculty should observe each other's teaching and learn each other's expertise.

Technology integration is not one-way ticket. Not only can computers be integrated into methods courses, teaching methods and ideas can also be integrated into the computer literacy course. That will make computer learning more meaningful. Though this course model was severely criticized, it is imperative that preservice teachers have necessary computer skills. "A required computer course serves a valuable purpose. It is important for the student who comes to a program with little or no previous experience" (Handler, 1993; p. 153). While the emphasis is placed on learning computer skills, students can be exposed to ideas of teaching with computers. For example, teaching spreadsheet can be tied to how to use spreadsheet to manipulate and teach math concepts.

There is yet another area into which technology can be integrated and impact preservice teachers' computer use - teaching practicum. Teaching practicum is a crucial period for student teachers because their experiences of this period help to prepare their future teaching style. "It is in these experiences that education majors become acquainted with the realities of life in elementary and secondary classrooms, look for real-world connections to content presented in their university foundations and teaching methods classes, and develop their instructional and managerial skills" (Hunt 1995; p. 37).

Handler (1993) found that observation and participation in technology use during the practicum played a strong role in newly graduates' perception of being prepared. Dougdale (1994) described a successful integration of a computer course into student teaching experience. Students were required to design curriculum unit integrating the computer and implement their projects in the real classroom setting during the practicum. Both students and practicing teachers considered the experience worthwhile and valuable.

Conclusion

Integrating computers into teaching practice is a complex process, impacted by many factors. Teacher education need to adopt multiple approaches to accomplish this goal. Offering computer literacy course, integrating computers into methods courses and teaching practicum all contribute to preparing future teachers in the use of instructional technology. As the world is racing towards the 21st century, few disagree that the computer will continue to impact our schools and societies. It is imperative that teacher education prepares their students for tomorrow's schools.

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The PREP Project:
A Multimedia Approach of Preparing Educators for Collaboration

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Professionals Ready for Educational Partnerships (PREP) is an interdisciplinary multimedia staff development program that incorporates stand alone video presentations, support materials, and CD ROM tutorial/assessment probes to help educators learn how to work together to serve students considered to be "at-risk." Conference participants will see the videos and have "hands-on" opportunities to interact with the CD ROM tutorial/assessment probe. CDs use full motion video and audio clips in a series of questions and vignettes to apply newly acquired information and skills. The CD ROM also provides immediate feedback to the trainee. The video component of the PREP project consists of 10, one-hour documentary video presentations. Viewers see prominent researchers and actual practitioners from various parts of the country implementing various forms of collaboration. Breakout activities conducted by a trained facilitator are interspersed throughout the video presentation to promote discussions and exercises. A detailed description of PREP can also be found at www.prep.utah.edu.

Internet-Based Multicultural Instructional Activities

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Abstract: This paper discusses using the Internet for multicultural education -- as a powerful tool for intercultural communication, as an effective facilitator for cross-cultural cooperation, and as a rich resource for multicultural curriculum. Research studies and findings are reported. Barriers to using the Internet for multicultural education regarding communication, cooperation, and curriculum integration are identified. Implications for designing Internet-based multicultural instructional activities are presented through the introduction of a ten module Internet-based multicultural lesson plan.

Teacher education and diversity -- these terms are becoming increasingly connected, as United States demographics are changing. While many school populations include growing numbers of minorities, some still do not. As we prepare our K-12 students to live in this world where multiple cultures are often represented in neighborhoods, schools, and the work place, it has become essential to find ways to provide these students with experiences that will lead to success in their future lives. To do this for our K-12 students, we must first be sure that our teachers -- both current and future -- understand theories and practice related to multicultural education.

Based on an analysis of multicultural education research, Ladson-Billings (1994) concluded that five areas played a determinant role in education of a multicultural society: teachers' beliefs about students, curriculum content and materials, instructional approaches, educational settings, and teacher education. Banks (1994) maintained that education in a pluralistic society should aim at students' understanding of their own cultural boundaries. Therefore, multicultural education is not a subject to be taught separately from other instruction; rather, it should be integrated into activities and subjects in education.

Research studies have shown that the Internet may play a very significant role in multicultural education. The Internet has great potential for providing a sense of community (Lapp, 1995) and cultural awareness (Davis & Ye-Ling, 1995) in intercultural cooperation, for supporting distance communication and language learning (Davis & Ye-Ling, 1995; Oliva & Pollastrini, 1995), for supplementing face-to-face communication (Lapp, 1995), and for providing a rich resource for curriculum integration (Boldt, Gustafson, & Johnson, 1995; Griswold, 1994; Jacobson, 1995; Wilson & Marsh, 1995). Additionally, it has been found that many educators have positive beliefs about using the Internet for multicultural education (Yin, 1997).

The Internet and Intercultural Communication

Research literature suggested that the Internet could facilitate intercultural communication because of several features. It may allow communication at a distance; it may supplement face-to-face communication; and it may actually enhance face-to-face communication.

One of the apparent advantages of the Internet is its power to connect distant people. Davis and Ye-Ling (1995), Duncan (1995), and Dowden (1996) reported that students from different geographic locations communicated with each other from a distance in either synchronous or asynchronous manner, made friends worldwide, improved learning and cultural awareness, and became global citizens.

Lapp's (1995) study indicated that the Internet could be a supplement to face-to-face communication. Whereas face-to-face communication determined the level of disclosure and cross-cultural understanding, online communication helped people to express a willingness to share intimate details of their lives. The college International E-Mail Classroom Connections mailing lists described by Rice (1996) enhanced students' intercultural contact. Mathies and Nelson (1995) found that online communication facilitated friendly interaction among individuals who did not know each other.

Research literature showed that the Internet and computer mediated communication (CMC) not only facilitated communication among people at a distance, but was also useful for communication among people who had face-to-face communication opportunities (Anderson & Lee, 1995). In Anderson and Lee's study, the subjects met on a daily basis. However, e-mail facilitated the sharing of ideas and resources; it also helped in building a sense of community by serving as a tool for students in assisting and affirming each other. Similar conclusions was drawn by Mendoza (1995) who found that when admitting feelings and thoughts, students tended to prefer computer rather than verbal expression. This is because "forum and assignments that address issues of cultural difference and racism allow students to sustain a formal discussion of these concerns in an environment that is still formal but which is not as 'risky' as face to face discussions" (p. 9). Uneasiness caused by eye contact, shyness, and body language in face-to-face communication could be reduced by the electronic environment. Beauvois' (1995) study also suggested that an electronic environment allowed moderating ideas, phrasing and re-phrasing thoughts, and making necessary error corrections. Therefore, pressure and anxiety which happened normally in language learning had been lessened. Based on data analysis of educators' beliefs about using the Internet for multicultural education, Yin (1997) found that many educators also believed that a combination of online communication and face-to-face communication could enhance each other in multicultural education.

The Internet has the potential to be a powerful tool for intercultural communication. However, barriers with regard to the use of the Internet for multicultural education for this purpose have also been reported.

Although e-mail was regarded by preservice teachers as a unique way of expressing themselves, Russett (1994) found that the depersonalization aspect of telecommunications was also detected. This supported Kiesler, Siegel, and McGuire's (1984) finding that "electronic communication tends to seem impersonal. Messages are depersonalized, inviting stronger or more assertiveness in return" (p. 1125). Lapp's (1995) study reported both successful and unsuccessful characteristics of online cross-cultural communication. According to Lapp, individual roles and responsibilities, sharing of personal lives, and equal opportunities for both cultures rather than the dominant culture determined successfulness of online cross-culture communication. However, topic unfamiliarity, language proficiency, and cultural incongruity caused barriers of building online cross-cultural community. Lee and Knupfer (1995) also reported that language was a problem. The study showed that when students of other countries who had limited or no English language skills, the cross cultural communication between them and American students were impeded. A related potential problem is "flaming" which could occur because of violations of the Internet culture, difference in values, and misunderstandings of each other (Wang and Hong (1995).

The Internet and Cross-Cultural Cooperation

Cooperative learning has been regarded as one of the most effective approaches for multicultural education (Banks & Banks, 1993; Bennett, 1990; Grant & Gomez, 1996; Slavin, 1983; and Sleeter & Grant, 1994). Various cooperative learning projects on the Internet have shown promising results. These include campus-to-campus activities in the United States (Abernathy, 1995), as well as cross-country and

cross-cultural projects (Anderson and Lee, 1995; Casey, 1994; Cutler-Landsman and Wrzesinski, 1994; Lapp, 1995). As these studies and projects have suggested, online activities encouraged cooperation, decreased students' feeling of isolation, motivated students' learning, helped students in gaining confidence, and improved student's sense of responsibilities for their own learning. Therefore, the Internet could be a potential effective facilitator of cross-cultural cooperation.

Nevertheless, cross-cultural cooperation on the Internet could not be successful if there was a lack of equal-status contact between majority and minority groups, as suggested by Allport (1958). Lapp (1995) studied cross-cultural communication between American volunteers, who represented the dominant culture, and graduate level ESL (English as a Second Language) students. The findings indicated that if the dominant culture representatives would like to encourage ESL students to initiate topics and would like to share details of their lives, both parties would have to trust mutually for the communication and cooperation to be successful. These research results were supported by Aoki (1995) who found that a lack of mutual negotiation among participants from different cultures could be a barrier to cross-cultural cooperation.

The Internet and Multicultural Curriculum

In recent years, the growth of the Internet has provided rich resource materials for the multicultural education curriculum. These include the comprehensive guide to multicultural resources on the Internet by Jacobson (1995), the women and minorities in science Internet site by Spertus (1996), and the African Americans in science site by Brown (1998) -- all of which have provided educators with useful resources for curriculum integration.

Several concerns, however, have been raised regarding using the Internet for multicultural curriculum resources. One of the main issues is reliability and authenticity of the sources, as identified by Neal (1995). Another issue is curriculum integration, as identified by Lee and Knupfer (1995). The former found that for certain subjects such as history, print materials had more reliability and authenticity than those on the Internet. The latter indicated that although there was a lot of fun and excitement using the Internet, the question remained how to integrate these into the existing curriculum. Findings of Yin's (1997) study showed that educators were concerned about relevance and authenticity, as well as the difficulty of curriculum integration while using the Internet for multicultural education.

A Modular Lesson Plan Format

Based on the research literature, a ten module multicultural education lesson plan has been designed by Yin (1998) to go from theory to practice through the design of Internet-based multicultural instructional activities. A generic modular lesson plan has been developed, to be adapted for specific cultures, as needed. As the lesson plan indicates, the module activities start with an introduction to a poem, a piece of music, or a picture of a certain culture. The purpose of this introductory activity is to raise students' curiosity about a culture. The lesson plan emphasizes learning that is both student-centered and teacher-facilitated, with communication online and face-to-face, and cooperation among students from different cultures, along with involvement of parents or community members. Various activities in this lesson emphasize student exploration and experience. These may be adapted for a variety of age levels. Classes of preservice teachers might prepare material for various cultures, to help them become aware of the various cultures of their potential future students.

Module One is a virtual tour to a city or a region representing culture. Students observe everything on the web site through their own eyes and find something that interests them. Feelings and impressions are the main elements involved. After the virtual tour, the student writes about three things and tell why those were impressive.

Module Two contains relaxing activities which bring students closer to the culture under study -- for example, after checking online recipes of the culture, students try to cook a dish. This opens a window to learn folk customs, an important component of a culture. The teacher may invite a parent or a community member from the culture to school to visit with the students. Since some foods are prepared for festivals and

celebrations, they have special meanings for a culture. If possible, further online communication between students and guest speakers could be established via email.

Module Three may build on topics from Module Two, as students check out festival information online. Festivals reflects tradition, history, art, and other aspects of a culture. The students compare festival activities with those from their own backgrounds, finding differences and similarities between cultures.

Module Four has students check web sites about art in the culture under study, and write down their understandings and their unsolved questions. The teacher then invites a parent or a community member from the culture to the class to answer students' questions. Again, if possible, online communication between students and guest speakers might be established via email.

Module Five begins the online study of the history of a culture. In advance, the teacher should prepare a form for students to use to compare historical events of their own culture with those in the culture under study. The teacher should provide addresses of (or links to) authoritative or official web resources, and a discussion about the accuracy of information on the web would be appropriate at this time.

Module Six asks students to learn more about a culture by exploring the area of language online. These language sites should contain: a) visuals rather than just a description, of the language; b) audio so that students can hear the language; and c) interpretation or translation in student's own language.

Module Seven contains an online search and study of various elements of the culture under study. For example, students might examine the educational system of the culture. They might then compare the educational systems of both cultures describing the similarities and differences they have observed.

Module Eight and Module Nine allow students to explore the areas of philosophy and law of a culture or a country. Again, the teacher should be careful to provide authoritative (or official) web resources and to discuss authority and validity of online resources with the students.

In addition to the original modules, a tenth might be added, focusing on establishing wider and longer online communications among students from different cultural backgrounds. In preparation, the teacher might search the Web, visit school web sites of a culture, or post requests on lists to find possibilities of online cooperative opportunities. Students then might begin communicating with students of the culture they have been studying, for individual communication, or to participate in research and other collaborative activities.

As a culminating activity based on their explorations and experiences, and as a result of cross-cultural communication and cooperation, students may design and publish a web page about the culture they have been studying. This will be a reminder of their experiences, and may also encourage others to learn more.

Summary

The World Wide Web is a rich resource for multicultural education. This paper has provided some background of and suggestions for the integration of multicultural educational activities into the curriculum. An example of the implementation of the lesson plan described above may be found at http://muskingum.edu/~csun/lessonplan.html.
Additional resources may be found at http://muskingum.edu/~csun/cyin.html.

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EDUCATIONAL COMPUTING COURSE

A Constructivist Approach To Technology Literacy For Preservice Teachers

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Abstract: This paper is a report on the findings of a study conducted during an undergraduate computer science class for preservice teacher educators which was restructured using constructivist principles. Qualitative analysis techniques were applied to field-notes, transcripts of computer-mediated discourse, project evaluations, and an interview with the professor and student interviews. Quantitative analysis techniques were applied to an attitudinal survey, and student self-evaluations. Findings indicate that students meet the technical skills required in an introductory computer science course.

Introduction and Statement of Problem

As educators prepare students for the much-heralded new millennium, the acquisition of technology skills becomes imperative to make them key players in this new Age of Information. In traditional pedagogical strategies, the professor assumes the role of dispenser of knowledge and students are passive receivers who dutifully record and memorize this information. These strategies are simply inadequate for a generation of learners who can access information, play games, purchase products, and conduct global correspondence through access to the Internet. This new generation of learners will take their place in a society that is increasingly information-driven, and this rapidly evolving society will demand learners who can evolve quickly with it. These learners will have to be prepared to continue their education throughout the span of their working lives. The current shelf life of a technological degree is a mere five years, and it is estimated that 75% of the current work force will require some form of re-training simply to maintain their technological competency (Dolence and Norris, 1997).

Today, with information so readily available for public consumption, educators cannot afford to collect and transmit knowledge as if it were a static entity. Now they must respond to New Learners who live and work in this socioeconomic environment. A new pedagogical orientation will be required to serve the kinds of students who go beyond (simply) having a set of skills and a body of knowledge. A dynamic, student-centered pedagogy will be important for all learners as we enter this new century, and it is doubly important for those preparing to enter the teaching profession because the instructional approach they experience will not only set their attitude toward learning, but predispose those attitudes for the next generation of learners.

How can this new generation of learners function in an active environment which demands flexible problem solving skills and critical thinking? The pedagogical model of constructivism offers an answer to this dilemma. Constructivism is a way of building knowledge about self, school, everyday experience, and society through reflection and meaning making (Shor, 1992). One of the primary goals of constructivism is to provide a democratic and critical learning experience for students. It serves to open boundaries through inquiry and to avoid closing them through unquestioned acceptance of prevailing knowledge. It creates the realization that knowledge is never neutral, that the ways in which knowledge is mediated and created are as dynamic and important as the knowledge itself (Hirtle, 1996)

A constructivist orientation to teacher education is important if teachers are to encourage students in schools to develop problem solving and critical thinking skills and to apply, analyze, synthesize and evaluate knowledge, skills and attitudes. Pre-service teachers should engage in these processes throughout the entire teacher education program if we have any hope for a constructivist approach in the schools (White, 1996). Contrary to the evidence about the importance of constructivist pedagogy in teacher education, many teacher education courses are taught along a transmission model. The computer science course required at many universities is usually taught through a formal, didactic transmission approach causing students to learn rote skills with little working knowledge of how to implement them in other situations. This inert learning causes students to learn just enough to be successful in the context of the course they are studying, but the ability to use the acquired skills quickly diminishes from lack of use and lack of conceptual understanding about how and when to apply them. How can traditional skills-based courses organized along the transmission model be restructured so that students may not only acquire the requisite skills, but also gain an understanding of how to use them to solve real world problems?

The Study

In summer 1998, the computer science department scheduled a 'special' section of its introductory computing course, CS 138 Multimedia and Networking Computing. This special section was to be used to implement the constructivist principles identified above. Enrolment in the class was restricted to preservice undergraduate and in-service graduate students. The class was limited in size (13 students; 4 males and 9 females) and met each day from 8:00 am to 10:00 am for five weeks. The instructor was assigned to the computer science department and held graduate degrees in Higher & Adult Education and Mathematics Statistics and Computing for Education. He collaborated with an education colleague in the conceptualization of this course and some of the initial planning. This colleague acted as data collector for the study and co-author for the study.

The structure of the course was organized around two real-world problems.

- The Coming Millennium
- The Teacher Supply Store

Each problem was presented in the form of a case study to the students and both instructor and students collaborated in a deconstruction and analysis process to code the case study in terms of:

- Event sequence (Knowledge acquisition, Actions, Processing, Reflection, Evaluation)
- Tools (Advanced application, Grand Themes, Technology tools)

In addition, a set of meta questions were used to explore the sufficiency and completeness of the deconstruction process. Handouts illustrating one of the case studies and the deconstruction process will be provided during the presentation.

With the primary intent of the instructional approach being 'skills acquisition driving the need to know', the course structure was designed to apply computer applications to real-world, problem solving, rather than teach the technical skills in isolation. Traditionally, the course content would consist of six areas; using WWW resources, Word Processing, Spreadsheets, Presentation Applications, Databases, and Web Page design. In contrast, the instructor had three considerations in designing the new course

- To be problem centered
- To work within a collaborative framework
- To provide a context in which the requisite skills would naturally emerge.

The instructor performed three distinct roles: director and classroom manager to set the focus of each classroom session, facilitator for the deconstruction and analysis phase, and as technical expert on the use of computer software resources and their application to the case study.

Deconstruction and analysis of case studies were performed in a group setting. Initially the process used a chalkboard. As students became more aware and capable of using applications, notes taken during the analyses were written to a word processor and then e-mailed to the group. After the initial analysis and to facilitate the free flow of ideas, threaded message boards were used to allow continued group discussion free of time and location constraints.

Data were collected from a number of different sources including:

- Field notes taken by the co-investigator
- Interviews with students
- Attitude and skill surveys,
- Instructor-created web sites, and the transcripts of the threaded message boards.

The study was concerned with evaluating the quality of learning and student attitudes. How can traditional skills-based courses organized along the transmission model be restructured so that students may not only acquire the requisite skills, but also gain an understanding of how to use them to solve real world problems?

Findings

This course was organized according to constructivist principles. First of all, the instructor developed two problems to guide student inquiry: the millennium project and the feasibility study for a teacher supply store. The first problem, the millennium projects, was directed toward student personal interest. The teacher supply store project was directed toward students' professional interest.

The instructor designed the millennium project to give students the opportunity to gather, sort, and evaluate web-based information about the significant millennial issues, and to identify those issues which were most important and real to the students. The students used a number of Internet based tools to support the process including the use of web browsers, search engines, email and a forum (threaded message boards). Web page composition software was used to construct and publish a web page that reflected their interest and the issues they felt most important.

The instructor developed the school supply store project to appeal to the students' professional interests. The students were presented with the task of investigating the feasibility of starting a school supply store in a mid-sized town. The students were tasked with examining the market, evaluating prospective locations and deciding on inventory. The students were also given the opportunity to decide on how the store was organized and run. They utilized spreadsheets to develop a financial plan, word processors and web tools to locate and gather information on (real) prospective sites for the store and presentation software to simulate the presentation of the financial plan to a bank for loan purposes. Again the students used email and the forum to communicate ideas and information to each other.

All technical instruction was taught in the context of these two projects. The professor used direct instruction at the beginning of class period to give students information, which help the student decide on what actions needed be taken to move the project forward to resolution and to establish their priorities for that class period.

This scenario illustrates the professor's use of direct instruction in a large group format for the purpose of moving the project forward and teaching the students' necessary technical skills necessary to complete the "school store" project. Cooper is directing the class to plan for inventory purchase as they ascertain the market demands. He asked the class, " How much software and videos do you estimate would be sold in a week?" After some discussion the class estimated 5 pieces of software at $40 a piece for a total of $900 a month. Cooper entered the figures into an Excel chart he was projecting onto a large screen in front of the classroom.

Teacher Supply Store				
Item	Count	Cost	Selling Price	Revenue
Software/Videos	5		$ 40.00	$ 900.00
Workshops	1		$ 150.00	$ 675.00

Then, he asked, "How many workshops will you run a week?"
The students estimated one.
"How much will you charge?" he inquired?
The estimates totaled to $675 a month.
Cooper then prompted with, "School Supplies. How much do you estimate?"

The students estimated $50,000 and Cooper pasted this into the chart reminding the class, "Bear in mind that we haven't talked about teachers buying supplies, middle school etc. Do you think we could sell $50 a day, 6 days a week, times 4.5 weeks representing a month? That would be $1350 of school supplies." He copies it into appropriate EXCEL chart fields.

After the large group instruction, the students had an increased awareness of how to project inventory needs to market demand and they had the rudiments in designing a useful sheet in EXCEL. The professor then provided hands on practice in working in EXCEL as they moved into small groups to continue the project.

Cooper challenged the class, " I'm going to e-mail you this spread sheet. Seriously think about what you could do to increase your profitability." Between now and tomorrow, I want you to think. What could we be selling as a service. Expect this in the mail in the next few minutes and then you can play with it."

This challenge placed responsibility on the students to think about strategies for increasing profit margins and it allowed them to practice the new technological skill they had acquired as they worked on these strategies. He also utilized another of the courses technical objectives, "having the students be fluent in telecommunications technology," to deliver this assignment. Consistent with constructivist principles, the instructor placed responsibility for continuing learning and practice on the students and he stepped back into the role of coach or facilitator as he allowed student interest and choice to guide their inquiry. The instructor asked them to go back to the forum (threaded message board) and make a commitment about what they would research.

Cooper supplied just-in-time information that would extend students' technical abilities when they needed that extension to support the project. The students were unclear as to how to begin accomplishing the tasks before them. In this scenario, Cooper explained to the class the steps involved in small group decision making before sending them off to work in collaborative groups. He talked them through taking the issues of supplies and then presents the steps necessary in brainstorming the tasks involved in determining the store inventory. Then he suggested how students might divide out the necessary tasks

Students asked about alternate means of data collection. Cooper offered possible suggestions, "You could visit stores and write up a field report of your visit. You could interview teachers to assess their needs. I want to emphasize that you must make a commitment about who will be responsible for collecting what resources. You must think about what you are going to sell in their store."

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Cooper supplied just-in-time information that would extend students' technical abilities when they needed that extension to support the project. When students were uncertain how to organize their project activities, Cooper explained to the class the steps involved in small group decision making before sending them off to work in collaborative groups. He talked them through taking the issues of supplies and then presented the steps necessary in brainstorming the tasks involved in determining the store inventory. Then he suggested how students might divide the necessary tasks using technology to record and publish their results Cooper's just-in-time instructions on constructing an action plan provided the students necessary information to move the project forward, and his seamless integration of technology to support the project made the acquisition of technology skills a natural part of the learning process.

When Cooper, was not offering direct instruction, he observed and conferenced with individuals and small groups. In the following scenario, a group asked Cooper about how to collect data? Cooper offered possible suggestions:

"You could visit stores and write up a field report of your visit. You could interview teachers to assess their needs. I want to emphasize that you must make a commitment about who will be responsible for collecting what resources. You must think about what you are going to sell in their store."

He moved from group to group coaching and advising as students sat in front of their computers entering data into their word processing program. "When you talk about merchandising you're going to have to make some decisions. What are people going to buy? What are you going to sell?"

Cooper's continual redirecting students towards the purpose of the project kept students focused and made the technology skills they were learning in the process seem like tools that would help them achieve their project goals.

Data concerned the quality of student learning was gathered during the course and at the end of the course. Students were expected to perform five class demonstrations of the problem solving process using the technology tools as part of their grade evaluation. In the course of the semester the demonstrations utilized all

of the application tools. Grades assigned to the demonstrations ranged from 60% to 100%. The lower grades were generally a result of not applying skills that had been learned, and that were appropriate in the context of the demonstration. In addition students were expected to compete research/short-writing assignments. Again grades ranging from 60% to 100% were assigned. The writing assignments were word processed and e-mailed to the instructor. The lower grades reflected a lack of use of techniques already learned, particularly formatting and organization and structure in the writing. The instructor had a strong sense of the students feeling more comfortable with the research process but not with the reporting process. These results were in line with instructor expectations except that no students failed to complete an assignment and no student dropped the course.

At the end of the course students were asked to perform self-evaluations of their competency in a range of skills associated with six key areas:

- problem solving
- use of email
- word processing
- use of spreadsheets
- use of presentation software
- use of the world wide web

On a 10-point magnitude estimation scale, student self-evaluation scores ranged from 1 to 10. Class averages of the self-evaluation data were in line with instructor-graded presentations. Chart 1 indicates that students perceived they performed better with presentation applications, word processing and web applications than with email, spreadsheets and the problem solving process.

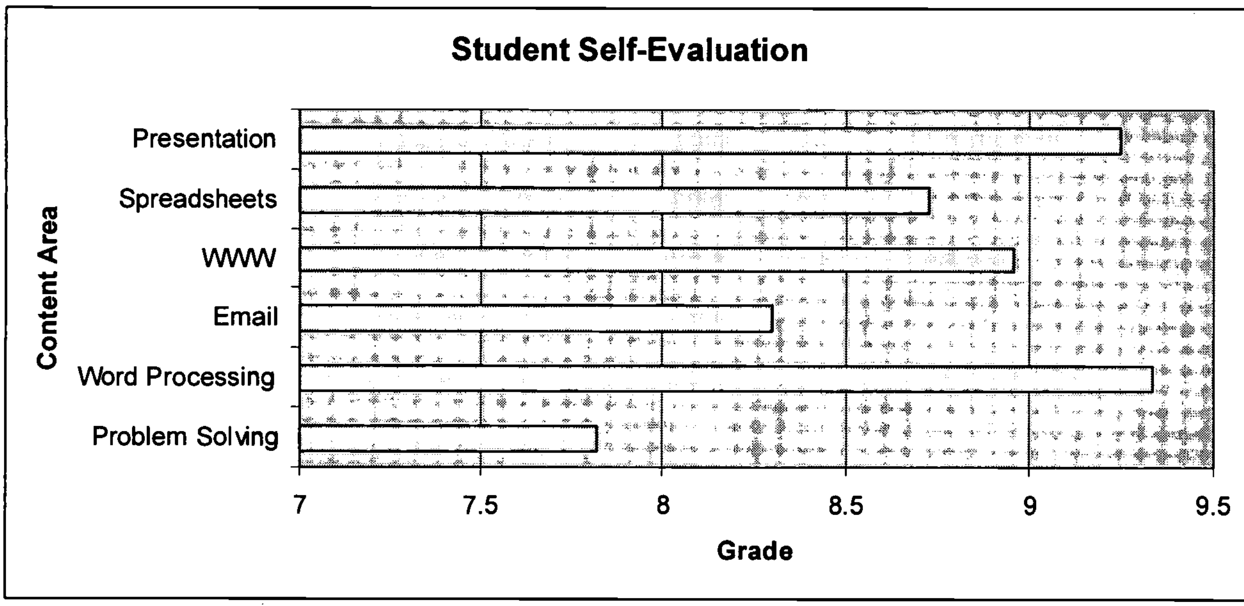

Chart 1: Average student evaluation scores

Threaded message boards were used to provide communication between the groups. The Millennium project forum, the first one used, recorded 46 message in a one-week period with most of the messages referring to new millennium locations. The teacher supply store forum recorded 125 messages in a similar time frame. The messages fell into two groups: brainstorming messages, where students tried to define the boundaries of their solutions to the case study and organization messages, where the groups divided the tasks among themselves and then reported back on their efforts. The students appeared to become more comfortable with the forums and used them more extensively and for more structured purposes in the second case study.

The students responded positively to the process and to the skills they were learning. They reported positive feelings about their technical expertise. One student reported, "I learn how graphics and sound add to a presentation. I also learned to save often. I really enjoyed this class. I never knew all these neat things happened on a PC. "Another student reported, "I also never knew all the things you could use a spreadsheet for.

I enjoyed learning about the formulas to use on a spreadsheet (you don't have to be good at math to use a spreadsheet). I enjoyed learning how to use Adobe Photoshop. You can do a lot of neat things to pictures."

Students reported feeling comfortable with both the content and the instructional process. Students reported :

> "I learned that the computer can read the written text out loud in an array of voices. I also became much more comfortable with PowerPoint, Excell(sic) and the web page composer."
> "I learned a lot about doing group work on a project. Group work is my least favorite thing but our group really worked together very well."
> "I know computers could be used for many things but I never knew it was this easy to learn to use them. I did not now you could create PowerPoint presentations and put them on the World Wide Web".

Conclusions and Implications

Students in CS 138 were expected to learn how use a number of software applications including office applications (word processor, spreadsheet, presentation) and communication applications (web browsers, page development applications and email). The constructivist approach used in this project provided the students with the time, motivation and resources to develop appropriate skill levels. In many cases, the students discovered and used additional features of the application (such as voice synthesis, threaded message boards) that would not normally have been examined in a traditional course. In addition, some students explored other applications (e.g. Adobe Photoshop) and hardware (scanners, digital cameras) to extend their capability.

The high interest projects in a collaborative setting established strong motivation. The inquiry-driven environment helped develop collaborative skills such as brainstorming, prioritization, checking for understanding, conflict resolution and establishment of consensus. Because interest was keen and motivation was high, students acquired skills any a way that seemed a natural part of the development. In some cases, students reported that not only were they surprised at their degree of technical competency once the course was completed, but they were surprised at how easy it was to acquire it. The investigators believe that the motivation increased the facility of skill acquisition.

The professor's role as well as the students role were restructured in this course. The professor took the lead in problem construction, encouraging self assessment and providing assessment, and in teaching technical skills lessons, as well as group management techniques. He took on the role of coach and encourager and became and adjunct to the teams as they worked their projects. He maintained his stance his professor and provided the necessary motivational and management strategies to organize multiple groups and class projects, but he was accessible and a valuable resource for the community as well.

The constructivist principles of encourage students to think critically as they solve problems, and learn the necessary skills to achieve their problem resolution in a natural way were successfully implemented in this pilot study

Implications

1. Students can learn technical skills collaterally in a constructivist, inquiry-driven curriculum.
2. Interest and motivation, by products of an inquiry driven curriculum enhance and accelerate technical skill acquisition.
3. Introductory computer science courses can be taught successfully in the context of students' professional content areas.

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The Value of Programming in Beginning Educational Computing

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ABSTRACT: This paper discusses in detail the nature of the conceptual development in beginning computing education for teachers and makes a case for the inclusion of programming experiences. The controversial nature of this perspective is addressed directly including a historical perspective. The discussion includes an account of some specific notions of computer operations, problem-solving skills and sound computing concepts that warrant programming experiences. The nature of holistic learning for preservice teachers, the concepts of education versus training, the demands on educators for mastery, problem-solving and adaptability in a quickly changing world of technology are issues brought to bear on the argument in favor of programming experiences in teacher education.

Background

One of the most controversial issues in the early computer education of pre- and inservice teachers is the inclusion of programming. This debate has raged since the earliest years of preparing teachers (and preservice teachers) to use computer technology. In the late 1970's and early 1980's as more teachers began to use word processing, many teacher educators argued that computer literacy should involve little more than word processing skills. Even at that time, when the availability of user-friendly applications was relatively scarce and programming was commonplace among "techies," its inclusion in beginning educational computing courses was controversial and opposed by many.

In the areas of computer science or data processing and information systems, students learn a number of programming languages as well as programmable database management programs. Nevertheless, such uses of computers, while considered essential and commonplace in those related disciplines, are typically opposed by educators of all sorts. Reasons for such opposition have varied somewhat over time. In the early 1980's opposition to the inclusion of programming experiences included arguments that programming is too difficult. Arguments even claimed that too few educators were really qualified to teach programming which seems like a self-fulfilling prophecy if educators never learn it.

However, most such arguments have been left in the past with the early periods of computer literacy movements. Today's opposition is somewhat different. Goals have changed. As information systems technology, instructional technology and educational computing have evolved into legitimate disciplines and as school systems and state education departments throughout the country have long focused on the integration of technology into education, computer literacy is considered passé and programming is often ignored or discredited.

Both in the earlier years and since, another factor has greatly influenced the argument. Educators simply do not want to do programming. It is considered too difficult, very confusing, too time consuming and educators fail to see any value in the applied, everyday usage of computers. Much like a child resists eating vegetables because they're distasteful and then fashions argument after argument espousing the merits of alternative diet options like peanut butter, educators have rationalized the exclusion and avoidance of programming as a useless endeavor and a distraction to more important areas of educational computing. However, these attitudes against programming, the resistance and inhibition of educators, do not constitute a worthy rationale against the value of programming - especially as a mere experiential component of early computer education.

Early rebuttals in favor of programming were generally weak and ineffective. The argument that programming would remain an inevitable part of computer use was never accepted and today seems even less believable. The argument that important educational software would be left to non-educators to develop or that, at best, an awkward cooperation between educators and computer programmers would be required was always a better argument. But, this too dissolved into the past as educators have continued to be satisfied with and accept the computing world as it has been given to them. That is, educators have been satisfied being mere users of computers and software allowing the real nature of their environment to be determined by computer scientists.

Programming

So, why should programming be included in beginning educational computing courses? And, if so, what sort of programming experiences? The notion of preparing educators who, with good programming concepts, can deal

with the development of new software has considerable merit but may still not convince teacher trainers focused on classroom issues. The idea that teachers do not do programming and thus have no need for the training is weak considering that there are different types of programming today. A number of common software programs involve programming skills (often called scripting) and also involve programming concepts (structure and design) all perfectly suited to the classroom teacher. Nevertheless, this argument is also frequently rejected, as educational computing students still do not want to learn programming.

Nevertheless, the real task is to prepare teachers to function successfully in the highly technological world that is developing. They, in turn, must be prepared to lead their students into computing, that is, to acquire the necessary skills to survive in our society. While many educators believe that programming has no place as beginners focus on the so-called tools of the applied utilities of productivity software, Jones (1990) specifically states that virtually all students in gifted and talented programs should be taught programming. It is suggested that learning programming languages aids students in learning to use computers as real tools. It is further suggested that the real value of computing lies in the problem-solving experiences of posing and answering questions. LOGO is one programming language claimed to provide opportunities to help students learn to integrate knowledge and share ideas.

Others have called for something different than the traditional skills of application software for beginning computing students. Eisenberg and Johnson, (1996), advocate an information processing model which specifically calls for computer programming. The point is to develop students with greater problem-solving and higher-order thinking skills. This, of course, stems from a perspective about what skills and knowledge teachers actually need and what really constitutes computer literacy. A great deal of literature has well documented the relationship between programming and improved problem-solving skills.

While usually a programming language is one avenue to improving problem-solving skills, Milbrandt (1995) documents the reverse: using problem-solving techniques to learn programming. Students learning computing concepts through a gradual increase in problem difficulty. Accounting for the importance of programming structures in computer studies, Milbrandt specifically calls for computing courses to incorporate as many programming language experiences as possible.

However, the exclusive focus on programming for teachers is clearly a thing of the past, and rightly so. Allan and Kolesar (1996) acknowledge the importance of including applications and tool-based skills of traditional courses, but such experiences are still suggested as preparatory for the programming experiences for beginners. It seems obvious that the quickly changing world of technology, the often challenging nature of computing tasks and the problems to which they are directed testifies to the importance of problem-solving skills. The conceptual development, improvement of problem-solving and higher-order thinking skills in computing have been directly linked to the inclusion of Logo programming (Allen, 1993; Battista, 1994; Borer, 1993; Dalton & Goodrum, 1991; Kommers, 1995) and BASIC programming (Overbaugh, 1993).

Many of the old arguments against programming will remain in the past where they belong. It is instead important to address the nature of computing and its demands for the conceptual development of beginning computing students. Ideally, technical details of programming can be identified in terms of benefits to improving understanding. The function of and the nature of characters in word processing are viewed differently with a programming perspective. The importance or relevance of data is presented differently in programming than in word processing. Handling different types of data (numeric / text) is necessary in using a database and spreadsheets and programming experience can directly impact those skills. Packaged functions in programming, the concepts of command, language, data, etc., the expandability of command sets (newly defined procedures in DOS or LOGO compared with Macros in word processing, etc.) - all support a conceptual relationship between experiences in programming and skills/performance using common applications software.

There is a convincing argument that many uses of computers today do in fact involve programming and that, as such, "programming" is being redefined, and thus effective use of many applications does require a well-developed programming perspective. For example, HyperCard is fashioned as a user-based application. That is, it is designed to appear like a database program (fields, records, etc.) for computer users when it is actually a type of programming language. HyperCard, HyperStudio, Toolbook, other authoring systems and Web page design, not to mention the highly technical task of programming HTML code - all very much involve programming concepts, skills and demand a programming mentality.

Some comparisons have shown that BASIC programming can out perform HyperCard programming for improving problem-solving skills. While HyperCard was superior in product development, BASIC is the preferred tool for improving problem-solving skills (Reed & Liu, 1992). The right approach to learning BASIC programming can help improve one's ability to understand and solve problems (Tsai, 1992). Henry and Southerly (1992) detail what is essentially an inappropriate comparison of attempting in BASIC, that which was done in HyperCard. After all, they are two different kinds of languages best suited to the production of different kinds of products. Nevertheless, both were deemed to contribute to the cognitive outcomes of improved problem-solving skills (HyperCard being the more user-friendly of the two).

The inclusion of programming in beginning educational computing courses, while misunderstood and resisted by many, will make educators better computer users, better teachers of computing and better able to assist students

with computing responsibilities. The improvement of critical thinking and problem-solving skills in educational computing is supported by another perspective.

Education vs. Training

The most common and seemingly worthy argument today against programming is that teachers will simply not use it. BASIC programming, while still an evolving, state-of-the-art high-level programming language, is disparaged and discredited as an ancient and useless pass-time - a distraction and pointless activity for modern educational computing agendas. LOGO is often misunderstood and widely ignored. Pascal, while often respected more by the computer science world, has also been dropped from many educational training programs. After all, educators do not have the time to program and, as any survey or field observation would show, most computer-using educators do not do programming.

While this might be true in one sense, it is not the proper issue. Surely a college education should produce more than simply memorized procedures and tasks accomplished. "A meaningful, unified computer literacy curriculum must be more than 'laundry lists' of isolated skills," (Eisenberg & Johnson, 1996, p. 1). It's impossible to only teach what will be used. The general computing skills of using the various parts of a computer system, managing lists of information, writing and creating products using word processors and other applications, do not help students transfer and apply skills in changing situations.

The inadequacy of mere procedural rituals, without a deeper conceptual understanding, has been examined throughout many years of research on educational computing (Galloway, 1992; Hobbs & Perkins, 1985; Kintsch & Greeno, 1985; Mawby, Clement, Pea, & Hawkins, 1984; Mayer, Bayman & Dyck, 1987; and Perkins & Simmons, 1988). In other words, a complete education is more than the sum of its parts whereas training consists only of parts soon to become obsolete. If concepts for beginning computing students (as compared to competencies) are not obsolete then neither are programming experiences which can directly impact that conceptual development.

Teaching the Whole Person

It is a common and dangerous misunderstanding in departments and schools of education that preservice educators acquire a liberal arts education and worldly knowledge from the other experiences in their undergraduate curriculum. It seems that educators far too often believe that such responsibilities fall on the other departments and schools in the university to educate the student leaving the teacher training program to focus on technical skills and mere competencies as if pedagogy is little more than a science of formulas to be mechanically applied. Education at the university level (especially for undergraduates), as distinct from the technical school or junior college, demands a more broad-based holistic program. The mere training of high school graduates to perform specific tasks without a more elaborate and general education will not produce competent and desirable teachers.

Today's naiveté, ignorance and misconceptions of beginning computing students is no less significant and fundamental than 20 years ago. Students have misconceptions about numbers, how to think about information, how to reason. Students lack perspectives which must be generated and cultivated. Today's teacher trainers must not simply train - they must educate. In this endeavor, it is important for college-level computer educators to teach about numbers, to teach about communication and thinking, to teach about organization and planning, to produce or pursue in a more holistic fashion that ephemeral and elusive thing called a complete education. The value of programming to contribute directly and significantly to that noble goal should not but is in fact regularly ignored, overlooked and undermined. The essential point about the inclusion of programming for beginning educators is not to produce programmers per se but to allow programming experiences to better educate computer-using teachers.

The remainder of this paper will focus on identifying some aspects of a programmer's perspective in contrast with that of a user that could impact the conceptual development of beginning computing students. Consider the following notions.

The Programmer's Perspective

Computer users tend to take the features of their computing environment for granted. For example, if a software product does not greet the user by name or display today's date conveniently at the top of the screen, users tend to accept such characteristics without question. A programmer on the other hand will more likely question the nature of the environment and seek to customize or modify available features. The distinction may often be a subtle matter of perspective but seeing and manipulating the basic commands of a programming language can help break down the mystique of computer operation. The anthropomorphization of using a computer is the misconception of the user to which programmers are immune.

There is a kind of designer mentality as programmers write, develop and debug programs. They plan for the deferred use of their products by the users for whom they labor. While the users see only the puppets on the stage performing the show, the programmers see the strings, the puppeteer and back stage construction of the set. Indeed, they design the show. This (programming experience) can make, not a subtle, but a profound difference in the perspective and mentality of a computer user.

There are a number of technical experiences in programming that can enhance computer use. The relative safety of "user"-mode fails to demand the proper concern for precision, planning and organization, simple good habits which can improve computer use. Errors can often be undone. It is not necessary remember commands as menus typically provide the opportunity to browse and guess until the solution is inadvertently discovered. However, while user-mode is relatively safe in the more modern software programs, there are wide ranges of use from effective and efficient to the awkward and inept.

What is a comma? What is a semi-colon? Etc. To many users, they are simply the symbols of sentence punctuation. To programmers and computers alike, such symbols are often the technical components of data manipulation, parameter specification and command structure. Too, their roles and function can vary from situation to situation. Programmers expect this. In programming, commands require specific syntax and structures. The exact nature of instructing the computer is in sharp contrast to the automatic help and auto-correction of errors in using modern commercial software.

Users typically create, manipulate and focus on the development of data. The notion that such data is virtually impotent and of little consequence to the computer is an interesting perspective. However, in programming this is commonplace. For example, in a program one may display either "Kat" or "Cat" and obviously the computer doesn't care. Users can often misunderstand that computers do not truly "know" about how words are spelled or what is intended in content - in spite of identifying misspellings with spelling checkers. In fact, the emulation of artificial intelligence by today's computers, so-called "smart" machines, can only exaggerate the anthropomorphic misconceptions of beginners mentioned earlier.

Exploring different "types" of data allows one to consider both the incidental and arbitrary nature of characters (as far as the computer is concerned) compared with the relatively potent and functional nature of numeric values. That is, "47" (mere characters) can be used for nothing but display and storage whereas 47 (the numeric value) can determine the number of times things occur or where or how something might happen. These notions, along with how numerals can be used as proper names (X19, R2D2) rather than always indicating numeric quantity, is uniquely examined and practiced in programming and is easily overlooked in the world of the user.

Packaged functions (UCASE$) can be considered an expansion on a language (set of available commands) and thereby constitute a variation on the simpler notion of command. Programming allows one to infinitely expand the limited set of commands provided in a language. For example, declaring subroutines in BASIC or Pascal create addition components to the basic language. Writing procedures in Logo creates additional commands, and while they're distinguished from primitives (the original set of embedded commands), they nevertheless constitute a personalized expansion on the function and capabilities of the computer as these new "commands" are added. Writing batch files in DOS similarly expands the base set of commands in the language and thus customizes the environment and develops computing power. Experience in programming allows one to relate to this computing power in important ways. The user-mode equivalent might be creating macros in word processors or spreadsheets, designing queries in a database or using any authoring tool (hypermedia or web design).

Beginning students, in general, seem to have difficulty with the concept of representation. That is, simply, how it is that a label can be made to represent something else and then be used in its place. Students often get confused using the label in stead of the thing being represented. While this is certainly important in using variables in algebra and computing alike, it is also a problem for students in common language. Studying the use of variables in computing (or algebra) can be a vehicle for assisting students with representation in language and communication.

For example, students often confuse a term like COMPLETE with a term like "COMPLETE" (when in quotes). That is, the term when used normally has a specific definition, in this case, meaning something in its entirety, whole, total, or finalized and finished. However, once placed in quotes, the term no longer means the same thing. That is, the term in quotes is used as a kind of label to represent something which is in actuality not whole or finalized at all, but which will be accepted as such. For example, I was reading a book and I stopped once my reading was "complete." This would of course mean that the reading actually terminated before the end of the book. It might mean that all interesting ideas in the book were covered and, that being sufficient, the reading was finished and considered "complete." Of course, it does not mean that the reading in any way truly covered all words or all pages. Students will frequently fail to understand this distinction and how terms can be used as labels to represent other ideas.

Variables in programming allow students to work with data through their representative labels. An astute instructor can present variables in ways to force students to focus on more than their function in an algorithm and teach students about the notion of representation itself. For example, a numeric variable in BASIC (B3) could have as its value the quantity of five (5). While another numeric variable (B5) could have as its value a quantity of three (3) - (B5=3, B3=5). Also, a string variable YES$ could equal "NO" while another string variable NO$ could equal "YES". Using these variables, these labels which represent other data, can help lead students to explore important

aspects of using language. Consider responding with the appropriate string variable to answer "Does B5 plus 2 equal 7 ?"

The arbitrary nature of labels, (it has been said "what's in a name?"), is important in computing, logical thinking and problem-solving in general. To what extent does the range of representation extend? It is a temporary or local representation or more global affecting other procedures and routines. This is certainly relevant in HyperCard scripting (a task often taken on by non-programmer educators). The view that spreadsheet cells are actually variables taking on values as data are entered is a perspective lost to non-programmers.

Design issues frequently arise in a number of hypermedia authoring packages like HyperCard, HyperStudio, Toolbook or other programs that are supposedly designed for the average "user" and provide an automated system of controls for creating packaged experiences. Users are typically made to believe that this is not programming whereas programmers not only understand how this is programming but may even seek a greater and more direct control of the language or authoring tool involved.

Loops in programming offer opportunities for students to explore how situations can be manipulated with numeric values. Recently this author asked students to name all even numbers between 1 and 10 (inclusive). Students correctly responded: 2, 4, 6, 8, 10. Then students were asked to count from 1 to 10 by two's. Students erroneously replied again with 2, 4, 6, 8, 10. (Correct answer is of course: 1, 3, 5, 7, 9.) The logic of program flow, the way numbers affect situations are all important aspects to using computers which can be experienced in programming.

IF/THEN logic is often lost on many people - not the least of which are beginning computing students. For example, "if mom comes home then I'm going to the store." Such a hypothetical is easy for most when the antecedent (mom comes home) is true. However, when students are asked what happens in the case of mom not coming home, they often answer "I don't know but you're not going to the store." When they are told that "I'm going to the store anyway" they often fail to understand the logic. After all, the original hypothetical did not say "if and only if mom comes home...." In fact, it never addressed what happens if mom does not come home one way or the other. Such basic elements of thinking and problem-solving are easily explored and experienced in programming. The complete flow of programs which branch from section to section based on this or that force programmers to learn logical consequences and improve reasoning skills. Computer users can benefit from such education (as distinct from training) and would be better users because of it.

There are many aspects to what programmers experiences which have a direct impact on the use of applications software. For example, users view everything but displayable characters in a word processor as "space." The real nature of a space (ascii code 32) as a real character is a fundamental aspect of data in programming. Users view commas and semicolons as sentence punctuation symbols whereas they are data delineators for programmers. Formatting fields in a database or cells in a spreadsheet is a natural part of handling data types in programming. Analyzing the content of a display would involve different considerations from a programmer. - a different perspective - than found in a computer "user." This perspective is often a critical difference between users who do and do not have programming experience.

In summary, arguments against programming actually fail to support the total avoidance of programming just as pro-arguments do not suggest that beginning courses should consist entirely of programming. The issue is not to distinguish programmers from users but to distinguish users with programming experience from those with none. Beginning computer education should include at least a brief programming experience to help build stronger concepts, adaptability, and problem-solving skills for our future educators.

This paper and other papers can be found at the author's personal web site for papers....
http://ww2.netnitco.net/users/jpgtma/papers.htm

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Does Asparagus Grow in the Can? Gently Lifting the Veil of Abstraction to Introduce Computer Literacy/Discovery Students to Computer Science

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Abstract: This paper describes how pre-service candidates for computer applications certification are gently introduced to computer science concepts and given tools for teaching them as components of the computer literacy/discovery classes. An inter-disciplinary approach is taken involving a computer science and a computer applications course where concepts taught in one are used to introduce and/or reinforce those taught in the other. Concepts are linked between the two courses in an effort to establish advance organizers for new material.

A kindergarten teacher asked her students if anyone could tell the class where we get asparagus. One student replied, "From the supermarket" another replied, "From a can". Speaking abstractly, both were correct. The knowledge and details of farming were unnecessary in order to enjoy the finished product. A high school teacher asks, "How do computers work"? A student might respond with, "You move the mouse and click the button on the picture of what you want it to do".

Computer literacy and discovery courses are often taught by computer applications teachers and generally expose students to the role of computers in society along with some opportunity for skill building using *canned* application software. Since it is not necessary to understand the architecture, design, algorithms, and engineering that underlie these systems, little emphasis is usually given to these concepts thus the *behind-the-scene* operation remains an abstraction to many who acquire respectable computer applications skills. Knowing how a computer works is not necessary for its successful use.

It is ironic that one of the most important conceptual tools in computer science, abstraction, (the hiding of details between levels of design and implementation) often prevents students from seeing or experiencing the activities or intellectual tasks related to computer science. In fact, many students incorrectly equate the use of application software with computer science. As a result, students who might find the field of computer science to be pleasantly challenging never get the opportunity to explore the field within the computer literacy class. If we accept the premise that conventional literacy includes not only the ability to read written works but also the ability to understand and participate in the creative processes behind their composition, then should we not expect computer literate students to understand and have the opportunity to experience some of the creative processes and engineering behind the systems we teach them to use?

Pre-service candidates for computer applications certification are introduced to computer science concepts and given tools for teaching them in the computer literacy/discovery classes. An inter-disciplinary approach is taken involving a computer science and a computer applications course where concepts taught in one are used to introduce and/or reinforce those taught in the other.

One goal of these courses is to provide both an understanding of and hands-on experience with several of the main areas and concepts related to computer science in addition to applications and simple programming. This approach differs from that taken in most *traditional* introductory computer science courses where a programming language such as C++ is used to slowly introduce concepts as students battle the details of syntax. By using and discussing the logic and arithmetic function components of spreadsheet and database applications, pre-service teacher candidates experience programming tools without becoming directly

involved in programming. This experience establishes advance organizers or *conceptual hooks* for the algorithm and programming concepts that are experienced in the computer science class.

A second goal is to provide the skills and tools to the soon-to-be practitioners to enable them to provide instruction of these concepts within the courses they will teach and thus provide their students with a glimpse of computer science.

The two courses are Microcomputer Applications in Education (MAE) and Introduction to Computer (science) Education (ICE). Although the focus of MAE is on application software such as spreadsheets, databases, and use of the internet, the focus of ICE is on problem solving, programming, and architecture, we have found that there are many concepts which may be cross referenced or linked between the higher level applications software taught in the MAE course and the somewhat lower level tools used in the ICE course.

Theoretically, students should be able to transfer their knowledge of a concept experienced in one course to more easily assimilate a similar or more detailed treatment of a known concept in another. However, research indicates that: 1) students do not automatically transfer learning to a new context, 2) context is critical to understanding, 3) active learning is necessary to develop skills, and 4) higher order learning is derived from experience (Johnson and Thomas 1992). With these facts in mind, and realizing that the context in which the concepts are presented within the two courses is different (application vs. computer science), we decided to attempt to actively link the related concepts through our instructional design and presentation.

By making these links, we begin to bridge different levels of abstraction and unveil some of the tools of the computer scientist to the computer applications user. The cross referencing begins when an application concept such as using a monthly payment function within a spreadsheet cell is taught and mastered in the MAE course. When students have become familiar with the concept of using a *canned* function and are comfortable with its use, the instructor explains that a function is similar to a formula evaluation subprogram. Later, when the student learns to evaluate formulas in the ICE class, the instructor begins by stating that the details of the new concept underlie the familiar monthly payment function in the spreadsheet from the MAE course.

This approach is appears to be consistent with the advance organizers theory presented by David Ausubel. Advance organizers are defined as conceptual material learned in advance of the main and more detailed learning material. The advance material is "at a higher level of abstraction, generality, and inclusiveness" than the learning material (Ausubel, 1963). The advance material provides a *big picture* or cognitive frame, which may contain labels for concepts along with hierarchical relationships among them. When the more detailed learning material is experienced, links may be made between the detailed new material and the existing structure provided by the advance organizers. Many studies have shown the positive effect of advance organizers on learning and retention (Story, 1998). Successful application of this theory requires that the learner internalize the links between concepts and details (Hawk, McLeod, & Jonassen, 1986). In our approach, the links between concepts are intentionally taught along with both the advance organizers and learning material. We may be taking some liberty with Ausubels's definition since the learning material in one course (MAE) becomes the advance organizers for the other (ICE). From another viewpoint, the new learning material becomes reinforcement for the previously experienced material since the links are made in both directions through the levels of abstraction.

Computer applications classes such as MAE provide a great medium to introduce many of the fundamental concepts relative to programming and taught in ICE . For example, the functions and expressions for computing cell values in a spreadsheet closely resemble the functions and arithmetic expressions often used in assignment statements in a programming language. Macro definitions in both word processors and spreadsheets often resemble computer programming statements and require an understanding of the importance of the proper sequencing of instructions or commands. Database queries involving logic operations are similar to conditional statements in computer programming and require some understanding of relational and Boolean logic. The exposure to Boolean expressions within a database query provides an organizer that may be used to promote an understanding of the gate-level logic that resides deep within the hardware of a system.

The advantage of introducing these concepts through high-level application software is that most of the details necessary to implement the concepts are built into the application. In a programming language the programmer must address the details and beginning programmers often become confused as they try to design the details of a concept that they don't fully understand. The same is true with the details of logic circuitry. By separating the teaching of the concept from the details of its implementation, we are able to use the tool of abstraction to our advantage when introducing important material to students.

The table below relates several of the concepts, examples, and links between the two courses:

Concepts	MAE Examples	ICE Examples
Sequence; Function; Expression Evaluation; Top-Down Design	Spreadsheet Monthly Payment Function; Macro	Qbasic Program for Monthly Payment Formula; Logo Design Project
Selection	Database Queries; Search Engine	Qbasic Program for Simple Quiz
Looping	Database Queries; Macro for Future Value	Qbasic programs for Future Value and Record Searching
Subprogram Modules	Macro; Database GoSub	Logo Procedures
Relational/Boolean Logic	Database Queries; Spreadsheet If Then	Qbasic Loop Control; If Then Else; Logic Gate Simulator
Lists and Array Operations	Vlookup; Hlookup; MATCH	Match Program
Software Engineering Teamwork		Group Logo Project
Architecture; Data Representation		Paper Computer
Logic Design		Logic Simulator

Table 1: Concept examples and links

As an example of creating a link in the MAE course, consider the teaching of simple database or search engine queries where the student learns to create a relational or Boolean expression to be used in the search. At this point, the student need only understand the concept of relational and Boolean logic. The database or search engine takes care of the details of reading and comparing the records within the database. The student is told that the software examines the records in the database for matches but it is not necessary to understand the details of the looping algorithm or instructions that perform this task. It is also explained that these details are the concern of the programmers who created the database program and that they will see this in more depth in the ICE course. The term loop might be used in the discussion that briefly describes what happens once a query has been made. When students are introduced to selection with the Qbasic if-then statement in the ICE course they are reminded of their experience in the MAE Course and told that what they know about creating a query will directly relate to what is about to be presented. Although students will not be writing a complete database program, their past experience will provide the context necessary to understand where if-then statements are used. The same is true for introducing loops and data statements.

Another example would be to teach the use of the future value function within a spreadsheet in the MAE course. The student learns what is meant by future value and what data is necessary to calculate it. Once this is understood, the student learns to put the built-in function in a cell and supply it with the correct data. The spreadsheet does the rest and calculates the future value. Again, the instructor tells the student that they will see the details of how this is calculated later and that what they have just learned will be useful at that time. When count-controlled loops are presented in the ICE course, an example is used to calculate the future value of an investment. The instructor states that the example will make use of their knowledge of future value calculations. Without this, the instructor would first have to introduce the concept of future value and make sure that students understood the process that was going to be automated with the loop program. This would require discussion of what input data was needed and what the result represents. Only after this concept was clear could students understand the programming material to be taught. Since there would be several new concepts being presented in a short period of time this might make the goal concept of looping more confusing than necessary.

There are some concepts in the ICE course which don't directly link to ones in the MAE course but an attempt is made to link as much material within a course is as possible. For example, a single, simple arithmetic evaluation program example is used to introduce the concept of data representation, wired-program and stored-program architecture, machine language, language translation, assemblers, and compilers.

The Logo language is used to teach the concepts of top-down-design, software engineering teamwork, project development, and recursion. Students enjoy working with Logo and create programs that draw pictures and designs. They have fun and receive immediate feedback on their work. At the same time they are making use of some of the main tools of the computer scientist. The instructor points out that what is important about their experience with Logo in not the drawing of pictures but rather the process by which they organized, planned, and delegated the tasks associated with drawing the pictures. When the class moves on to programming in Qbasic, the process and concepts learned in Logo seem allow quicker assimilation of the new material.

Logic gate circuitry is introduced through a plumbing analogy with valves and faucets representing gates. AND and OR *plumbing* is presented to no one's intimidation. The next example replaces valves and water with gates and electrons. After these concepts have been taught students create and test logic circuits with an interactive logic simulator.

Although no formal evaluation of these methods has been made, students seem to show less anxiety about learning a new computer science concept when the concept can be related to a previously introduced topic. We intend to refine these methods and search for other concepts that may be linked between and within the courses.

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Finding New Avenues for Motivating Preservice Teachers by Web Enhancing a Technology Course

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Abstract: Many schools and colleges of education are placing emphasis on the preservice technology course. Research confirms that an initial course is the first step in creating opportunities for preservice teachers to see the real value of using technology in the classroom. A number of colleges of education are beginning to offer their students Web-based and Web-enhanced courses. The enormous growth of the Internet has provided instructors with new avenues for delivering university courses. The purpose of this study was to determine if Web-enhancing an introduction technology course would result in increased student learning and motivation to learn. Results of this qualitative study revealed that a Web-enhanced introduction to technology course was an overwhelming success.

Introduction

In many schools and colleges of education, a great deal of emphasis is being placed on the preservice technology course. This course has become the front runner or introduction to many of the methods and specialization courses (Clawson, 1996). This course is also the first step in creating opportunities for preservice teachers to see the real value of using technology in the classroom (Gunter, Gunter, & Wiens, 1998). Faculty have realized that students still need coaching when it comes to technology use. The initial course is not only a building block for other courses but also where basic skill levels must be attained before a student can truly teach with technology (Schwartz & Beichner, 1999). The initial experience with technology should not only be a positive one, but one that creates a desire for more knowledge. Students need to have the desire to learn more and use technology in their owns lives (Shelly, Cashman, Waggoner, & Waggoner, 1998).

Educators in K-12 schools agree that schools have a responsibility to prepare students to be successful in a digital world. However, before a teacher can teach these skills they must possess a clear understanding of basic technology concepts and have an extensive knowledge of how to enhance the teaching and learning process with the integration of technology. Recognizing that colleges of education must prepare teachers for this environment, the International Society for Technology in Education (ISTE) developed a series of foundation standards that preservice teachers must possess. These standards recommend the skills all new teachers should have as they enter the field of teaching (NCATE, 1997). Due to the focus on preparing K-12 students for the future, the International Society for Technology in Education (ISTE) also developed the National Educational Technology Standards (NETS) for Students in 1998 (ISTE, 1998). Technology is everywhere and if today's students do not know how to use technology, they will lack the skills necessary to enter a high-tech work force.

We, as faculty of higher education prepare teachers to teach in this environment. Teachers must be ready to not only use technology, but also to teach with technology and to integrate technology. Teachers should be able to assess technology resources and plan classroom activities using available technologies. Teachers should be taught how to match appropriate technology to learning objectives, goals, and outcomes. Learning to integrate technology successfully into classroom curriculum relies on a solid foundation of computer and information literacy (Shelly, Cashman, Gunter, & Gunter, 1999).

A number of schools and colleges of education are beginning to offer their students Web-based and Web-enhanced courses. The enormous growth of the Internet has provided instructors with new

avenues of delivering university courses (Kroder, Suess, & Sachs, 1998). These new courses normally are grouped in two categories, Web-based and Web-enhanced. In Web-based courses, students may only meet for one class session with the rest of the course taught on the Web. A Web-enhanced course is different than delivering an entire course using the Web. In a Web-enhanced course, students attend regular class sessions; however, instructors use the Web as a tool to supplement teaching and learning. The teaching techniques and strategies for the Web-enhanced course vary greatly.

Background and Methodology

Results of a pilot study and an extensive four-semester study conducted on a redesigned introductory technology course at the University of Central Florida determined that the course was successful and effective (Gunter, Gunter, & Wiens, 1998). These findings revealed that students in all sections over a four-semester period had statistically significantly less anxiety after completion of the redesigned introduction to educational technology course. These findings confirmed that the restructured educational technology course made a difference in these students' attitudes toward computer technology.

Qualitative data from each student was also collected at the end of each semester using university student critique forms and faculty created forms. In additional, informal data was gathered throughout the semester when students were asked to reflect on their course experiences. The qualitative data analysis also documented the effectiveness of the restructured course. All student formal comments on the course were positive; the following are a few of the documented examples: "I thoroughly enjoyed this course." "This class has built my confidence with computers!" "I found myself wanting more and more to use technology in the classroom as a learning tool." "I learned so much. I can not explain how important this class was for me. "I learned much about technology integration." "Before I have always been very shy of computers, to think that I made a PowerPoint presentation, among other things, blows me away--thanks!"

Through quantitative and qualitative statistical analysis, it was documented that the restructured course was successful and positively changed students' attitudes towards the use and integration of educational technology. Data analysis revealed a statistically significant change in students' attitudes toward computers over the semester. This research verified that the introductory course was successful in significantly reducing the incidence of computer anxiety.

Knowing that the restructured class was successful, faculty continued to look for more avenues to motivate and excite preservice teachers toward using and integrating technology into their classroom curriculum. More than ever before, the Web has made it possible for teachers and faculty to go beyond the classroom and find resources at their fingertips. The transition to a Web-enhanced course seemed like a natural and wise decision.

For this study the researcher used the university student critique forms and a faculty developed qualitative form for course evaluation. In additional, informal data was gathered throughout the semester when students were asked to reflect on their course experiences. A questionnaire with four qualitative research questions was developed by the researcher to determine if the Web enhanced course influenced student experiences in the course related to the acquisition of authentic technology skills and integration skills. The research questions were: (1) What are some of the advantages and/or disadvantages of the way this course used the World Wide Web to enhance course content? (2) What words and phrases would you use to describe the information and assignment hyperlinks that were provided for you at the course Web site? (3) How would you describe your experiences in EME 1040 this semester? (4) Is there anything else that you would like to say about EME 1040?

Purpose of the Study and Description of Sample

The purpose of this qualitative study was to evaluate the effectiveness of Web-enhancing all sections of an introduction to educational technology computer course taught at the University of Central Florida during Fall 1998. The course used for this research was EME 1040, Technology for Educators.

The sample utilized in this study were students enrolled in EME 1040, Fall 1998, who completed the end-of-course questionnaire. Eight-one students out of 90 enrolled in three section of the course participated in this study. Two different professors taught the three sections of the course used in this study.

Description of Web-Enhanced Course

Prior to the Fall of 1998, the introduction to technology course met once a week during the semester for approximately 3 hours and class size was limited to 30 students per section. Most class sessions consisted of 50 percent lecture in a multimedia presentation classroom and 50 percent hands-on in a computer lab. Whenever possible, introduction and practice of software programs were immediately followed by practical application of the software in an educational setting. Faculty wanted to not only instruct students on how to use current and emerging technologies, but also how to integrate educational technology into their future classroom. Integration of technology into K-12 classroom curriculums was emphasized throughout the course. Course assessment included weekly reflections on textbook chapters and experiences reviewing dozens of Web sites provided by course instructors. Weekly assignments and student projects were provided in traditional formats; (1) students were provided printed copies of syllabus at the beginning of each term, and (2) all assignments were reviewed and explained weekly by course instructors using PowerPoint presentations.

The modifications made to enhance the course with the Web did not alter the basic format of the course as described above. Instead, the Web was used as a tool to provided students with access to course content, assignments, and a multitude of resources. First, an extensive Web site (http://reach.ucf.edu/~eme1040) was created for all sections of the course. The Web site was updated weekly and as a result, was always current and up-to-date. By the end of the semester, the course Web site contained hundreds of Web pages containing hundreds of hyperlinks to Web sites pre-evaluated by course instructors for content, appropriateness, and K-12 curriculum integration value.

The course home page listed the six course sections and instructors. The home page also contained the extensive and detailed course syllabus. Each section was linked to unique section web page that contained a week-by-week schedule and links to thirteen individual assignments. In other words, all assignments and projects were stored as Web pages. Professors felt it would be beneficial to have all web assignments and links on the Web. This helped students avoid getting lost of the Web or getting nowhere because of incorrectly typed or forgotten Web addresses.

Findings

Qualitative data analysis documented the effectiveness of the Web enhanced technology course. Students' perceptions of new and changing technology environments was considered an essential part of the course's success. Clearly, Web-enhancing this course was a successful addition to an already successful introduction to technology course. Summarized below is a cross-section of student comments dealing with each of the research questions.

Research Question 1

The first research question asked students to list their perceived advantages and/or disadvantages of the way the course used the World Wide Web to enhance course content. Under advantages, most students really liked having a Web source for their assignments. "Gave students the opportunity to have hands-on experience on the Web for the assignments." "The assignment-based home page made the WWW easy to access." "Allowed interaction with homework." "The course introduced me to the Web and excellent sites."

Under disadvantages, many students had two main concerns, which were a lack of computer access (especially at home) and slow Web speeds (at home and in the college's computer lab). "Lack of access to computers." "Difficult if you do not have the Web at home." "Sites took to long to load."

Research Question 2

The second research question asked students to provide words and phrases that would described the information and assignment hyperlinks that were provided at the course Web site. Students listed only positive word and phrases. There were no negative words or phrases reported for the question. Individual words listed by the students included: "helpful," "informative," "excellent," "fun," "interesting," "educational," "relevant," "cool," "insightful," "enlightening." Phrases listed by the students included: "I love having a web site to go to for assignments." "Beneficial for future use." "Student-friendly - easy for us to get where we needed to go." "Loved having a Web site to go to for assignments." "Very helpful." "Fast, easy-very easy, well organized and structured." "An enjoyable way of learning."

Research Question 3

The third research question asked students to describe their experiences in the course? All student responses to this question were extremely positive. "Fabulous - Would recommend to everyone. I learned so much and I know that I can use the information in my classroom." "I loved this class. I came into this class not knowing much about computers, now I feel very comfortable with them." "A great learning experience." "This is one of the best classes I have ever taken. I went from knowing nothing to comprehending many computer skills in this class." "Excellent, I really learned an amazing amount." "The best course I have taken at the university, I wish there was a part II." "I learned a lot without feeling overwhelmed." "It helped me learn ways to incorporate technology into my classroom." "I learned a lot that I can now apply to other projects." "I learned a lot of useful information and strategies."

Research Question 4

The final question asked the students if there was anything else they would like to say about the course. All comments were extremely positive. "I learned not to be afraid to try something new." "All students, not just education students, should take this course." "This is a great course for educators" "I think there should be more education courses that focus on technology." Teaches valuable lessons that can be used in many different careers." "Thank you for the information, One of the best classes I have ever taken!" "I really enjoyed it, thanks!" "Thank you!" "I loved it." Finally, one student answered this question by stating: "I think it should be required for all faculty to take this course. Our education would be greatly improved by it."

Conclusion

By developing instructional strategies that maintain a high-quality technology-based learning environment and by empowering preservice teachers through authentic technology learning experiences, the learning environment can extend beyond the classroom. Higher education faculty can promote the use of computer technology and the Internet best by integrating it into their own instruction. Web-enhancing this introduction to technology course was an overwhelming success.

However, planning and understanding of students' lack of abilities and access to technology had to be taken into consider when developing and enhancing assignments for the course. The time spent by faculty in creating and updating the course Web site paid significant dividends in enhanced student learning. The remarkable student comments document those dividends. All instructors and professors should consider finding diverse and innovative ways in increase student motivation and participation in their courses. Web-enhancing a course may be one possible solution.

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Research On The Characteristics Of "The Technology Course"

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Abstract: A report recently released by the National Council for Accreditation of Teacher Education promotes the use of technology in colleges of education. In order to provide the best instruction on technology use, it is important to explore technology courses at colleges of education. The purpose of the study is to investigate the one course that is often called "The Technology Course." Structures and contents of the course at twenty-five colleges of education are examined.

1. Overview

Today, more than ever before, we are experiencing a rapid change in the way we conduct our business and our lives. The advance of technology, on a regular basis, renders the way we communicate, teach, and learn obsolete. Currently students without computer knowledge and skills would no longer be accepted as they would years ago.

The business world demands schools to prepare the students for effective use of technology in their future work places. The president and vice president of the United States have publicly addressed that every child in the nation should feel comfortable on the Information Super-Highway. Moreover, the increasing number of computers at schools clearly speaks for the trend. According to Northrup and Little (1996), in the past ten years more than 300,000 computers have been added. Computer-to-student ratios have also dropped consistently from 1:50 in 1985 to 1:20 in 1990 to an estimated 1:9 in 1997 (National Council for Accreditation of Teacher Education, 1997).

All of these facts indicate that new technology is affecting our classroom practice and also the culture of the schools. The technological influence is challenging our teachers and will challenge the two million new teachers who will be hired over the next decade. Teachers should feel comfortable with the new culture of the schools and be ready to teach in the "Information Age." Do teacher education programs prepare their students to face the challenges? Unfortunately, the answer is no; most programs "have a long way to go" (NCATE, 1997, p. 1).

To answer the urgent need, the NCATE task force is assisting colleges of education to help their students take advantage of technology for instruction: new understandings, new approaches, new roles, and new attitudes (NCATE, 1997). The teachers need to understand the deep impact of technology on the nature of work, on communication, and on the development of knowledge. They must use a wide range of technological tools and software as part of their own instruction. They must help students in the use of technology to gain information that goes beyond textbooks and teachers. In addition, they should be fearless in the use of technology and be life-long learners.

In response to the call, colleges of education across the nation become equipped with new technological tools. Many programs are also offering technology courses to help their students to take advantage of these tools and to utilize them for enhanced learning. However, there has

been little discussion on what skills and knowledge students must have to take advantage of the technological tools (Old Dominion University, 1997). There is a need to investigate the courses offered in the colleges.

The following research focused on the one course that was often called "The Technology Course." It was a computer course commonly offered at colleges of education. The research expanded a preliminary study published in the Technology and Teacher Education Annual (Leh, 1998). The study investigated how the courses were taught and what was instructed in the courses at different colleges.

2. Research Questions

1. What structure is used for the course?
2. What content is involved in the course?

3. Procedures and Methods

In the preliminary study, nine universities were selected. They were Arizona State University, Florida State University, Harvard University, Indiana University, Massachusetts Institute of Technology, Pennsylvania State University, Stanford University, University of Virginia, and Yale University. They were selected because they were either considered to be prestigious universities or had good reputation of offering outstanding educational technology programs.

First, phone calls were made to the college of education of the universities to find a course that was preparing undergraduate education students on using technology for their future teaching career. During the same time, an Internet search was conducted to look for the course syllabi.

The initial phone interviews and webpage searches revealed that each university had its own way of preparing their students for the use of technology in instruction. Some universities, such as Stanford University, did not have education programs for undergraduate students. Therefore, the preliminary research focused on four of the universities that offered a similar computer course: Arizona State University, Indiana University, Pennsylvania State University, and University of Virginia. The preliminary research examined how the course was taught and what was instructed in the course. Phone call interviews were further conducted to obtain detailed information on this specific course at each university, and the course webpages were downloaded for analysis. The research results were presented at the Society for Information Technology and Teacher Education (SITE) in 1998 and published in the Technology and Teacher Education Annual (Leh, 1998).

Based on the findings of the preliminary study, the researcher expanded the study. First, the researcher collected data at two professional conventions: Association for Educational Communications and Technology (AECT) at St. Louis, Missouri in February 1998, and Society for Information Technology and Teacher Education (SITE) at Washington, DC in March 1998. Personal interviews were conducted in the conventions, and e-mail communication followed. Course syllabi were collected via e-mail and downloaded from the Internet.

Data was also collected from other universities that were convenient samples. They either had course syllabi on the Internet or were accessible by the researcher and her graduate students. No random sampling was involved in the selection. The data collection involved collecting syllabi via e-mail and the web, phone interviews, and personal interviews.

The study included a total of 30 universities: Appalachian State University, Arizona State University, Brigham Young University, California State University at San Bernardino, East Central University, Eastern Michigan University, Idaho University, Indiana University, Mankato State University, Michigan State University, Northwestern Oklahoma State University, Oklahoma City University, Oklahoma State University, Pennsylvania State University, San Diego State University, Southwestern Oklahoma State University, State University of New York, Texas Tech University, University of Alaska at Anchorage, University of California at San Diego, University of Central Florida, University of Central Oklahoma, University of Georgia at Athens, University of Houston, University of Iowa, University of Northern Iowa, University of Oklahoma, University of Southern Indiana, University of Virginia, and Valley City State University. Detailed course descriptions of 25 of the 30 universities were available. They were employed to construct the report in Table 1. URLs of some courses available during the research are no longer accessible. The references list URLs still active in 1998.

The data collection and analysis focused on structures and contents of the courses. Different course structures were recorded. Content topics on the syllabi were coded. They included (1) computer hardware and software, (2) word processing, (3) spreadsheet, (4) database, (5) telecommunication such as Internet search and e-mail, (6) multimedia, (7) presentation, (8) desktop publishing, (9) software evaluation, (10) computer issues such as copyright, (11) webpage development, (12) curriculum integration, (13) video, and (14) traditional media. The data was recorded and calculated using spreadsheet. The researcher and two graduate assistants independently checked the data.

4. Results and Discussions

The computer courses of the 25 universities were similar overall, but the details of the structure and content still varied from one university to another.

4.1 Structure

The computer course was a required course for students at most colleges of education, but not required for students at some colleges. Some faculty members thought that the course should be required while others did not. A faculty member at Appalachian State University discussed in an interview that no technology course was required in her college but starting 1999 there would be a "requirement for passing a technology competency test as one criterion for certification." She noted that it was a weakness having a competency test without offering a required technology course. A faculty member at Pennsylvania State University expressed different opinions. He mentioned that his college offered several computer courses to undergraduate education students and that "The Technology Course" could be a one-credit, two-credit, or three-credit course depending on the interest of the individual student. He thought that it was not necessary to require a specific course.

Should "The Technology Course" at the colleges of education be required? It depends on the philosophy of the faculty members and nature of the individual college. According to NCATE, teachers must have technology skills and knowledge. It is beneficial to offer a required course so that the students can systematically learn the skills and knowledge. Nevertheless, some students might have mastered the skills and knowledge before taking the course; they would get bored or

impatient in class. It is suggested that a competence test be administered and that students be given a waiver for the course if they pass the test. In some colleges, there is no such required course. It is recommended that the college conduct a competence test to ensure quality of the graduates. In this case, the competence test is essential. Michigan State University sets a good example. Students at this university are given an opportunity to choose a course or a competence test.

A competence test can easily evaluate students' computer skills and knowledge. Can it effectively access students' abilities of integrating technology into classrooms? Is it beneficial to have a required course focusing on technology integration after students master the computer skills? Or is it possible to blend integration into the technology course? Faculty member J. Bauer at the University of Northern Colorado used "anchored approach" (Bauer, 1998) to blend integration into his educational technology course. The idea is promising. However, can students really learn a lot of information like word processing, spreadsheet, database, presentation, multimedia, telecommunications, and webpage development within one single course? It might be useful for students to take a technology integration course after the technology course. In the technology integration course, the instructor can focus on integration and at the same time review what students have learned in the technology course.

Two main types of teaching structures were found at the universities. The similarity of the two structures was that both structures consisted of lecture and lab. In the lecture, students learned computer concepts, and they conducted hands-on activities in the lab. The difference between the two structures resided in where the lecture was conducted. Arizona State University was an example of the first structure, and Indiana University was an example of the second.

In the first structure, the lecture was conducted in a big lecture hall, which could accommodate numerous students. The concepts were taught there to approximately 100 students simultaneously. The lab was conducted in a small group at a computer lab, approximately with 25 computers, where students had hands-on experience. Students had two different instructors, one for the lecture and one for the lab. The lecture syllabus corresponded to the lab syllabus. The course instructors used identical syllabi, assignments, mid-term, and final examinations. They also conducted weekly meetings to maintain consistency of the course.

In the second structure, the course was conducted in a computer lab where the instructors taught both computer concepts and skills. The course instructors were advised to teach similar content. However, they neither used identical syllabi nor conducted weekly meetings. They were free to design and construct their own lessons.

Both structures had their advantages and disadvantages. The structure at Arizona State University was organized, and the course content was very consistent throughout different sections. This structure allowed the same content to be taught to more than 300 students each semester. Students taking the course were guaranteed to receive the same information. In addition, this structure allowed graduate students who were more likely able to catch up with updated computer skills to teach lab sections while faculty members provided expertise in concepts and theories during the lectures. The disadvantage of this structure was that the learning with numerous students in a big lecture hall might be less effective compared to the learning with only 20 students in a computer lab.

Unlike the first structure, students at Indiana University could access a computer at any time in class. They could also receive more attention from an instructor compared to students in a big lecture hall. The disadvantage of this structure was that students did not learn the same information from the same course. With enrollment of about 500 students per semester at Indiana University and involvement of many instructors, one might wonder what students

learned in the "same" course. An instructor of the course at the university addressed in a phone interview that the course content varied because each individual instructor emphasized different concepts and skills. Similarly an instructor at the University of Georgia said in an interview that some students learned video and webpage development in the course while the others did not. The instructors did not seem concerned about consistency of the course.

4.2 Content

At all universities the course content contained concepts and skills. Concepts included knowledge of computer technology, such as basics of hardware, and integration of computers into curriculum. Students were also expected to be able to demonstrate and master skills. For example, they should be able to type a paper using a word processor, record their students' grades using a spreadsheet, and keep the students' records using a database.

The table below (Tab. 1) reports topics that appeared in the courses at the 25 universities. The percentage indicates the ratio of the universities that taught the topics. For example, telecommunication was taught at 21 out of the 25 universities; hence 84% was listed.

Topics	Percentage
Telecommunications	84%
Multimedia	80%
Spreadsheet	76%
Webpage development	72%
Word processing	68%
Presentation	60%
Software evaluation	60%
Database	56%
Curriculum integration	52%
Computer issues	48%
Hardware and software	44%
Video	24%
Desktop publishing	20%
Traditional media	8%

Table 1: Topics included in the courses and percentage of the universities that taught the topics

It was found that the courses usually started with basic tool applications. They consisted of word processor, spreadsheet, and database. Many universities used ClarisWorks or MSWorks, package software containing these three applications. Few universities like Indiana University employed Word, Excel, and FileMaker Pro. Students were expected to demonstrate efficient use of these three applications. There was a trend of the course away from word processing because students had previously mastered the skill.

Beyond the three tool applications, students were instructed in the use of multimedia and presentation software. Many colleges utilized HyperStudio for multimedia and PowerPoint for presentation. Telecommunications like Internet search and e-mail became important components, especially since more and more schools progressively have set up their networks. The advance of technology constantly causes the change of the course content; more and more colleges were including webpage development into the courses.

While many instructors were following steps of technology advancement and included webpage development and multimedia production into the courses, few instructors advocated the importance of teaching traditional media, such as lamination and transparency. Although in this study a low percentage (less than 10%) of the colleges was found to teach traditional media, the instructors' rationale of teaching them was valid. They mentioned that technology in many public schools was very behind and that teachers needed to know how to use available technology, such as lamination and Apple II computers. Their statements pointed out a gap between technology preparation and technology use in real classrooms. They also addressed the importance of the linkage or collaboration between university faculty members and schoolteachers.

University instructors should help students to effectively integrate technology into classrooms. NCATE has voiced the importance of technology integration (NCATE, 1997). Partnerships between colleges of education and local schools can help education students to understand technology need and use in real educational settings. The partnership among San Diego State University, O'Farrell Community School, and Morse High School sets a good example (San Diego State University, 1998). Dialogues between university faculty members and schoolteachers (superintendents and administrators) are essential.

5. Conclusions

Technology development is affecting our schools. Teacher education programs are required to prepare students to understand their new roles, use new approaches, and have new attitudes for teaching in the Information Age. "The Technology Course" is strongly suggested to be offered to students at each college of education. A competence test is recommended to be available for students with good computer background. Integration of technology into instruction is definitely needed for preparing professional teachers.

Two main structures are employed at the universities, and each structure has its own advantages and disadvantages. It is suggested that a college choose a structure, which fits its individual institution. The course content consists of computer concepts and skills. The primary components include word processing, spreadsheet, database, multimedia, presentation, telecommunications (e-mail and Netsearch), webpage development, and integrating technology into instruction. With NCATE's directions, partnerships of colleges with local schools, and dialogue between university faculty members and schoolteachers, educators will provide students with skills of using technology and with abilities to integrate technology into curricula and instruction. Students with these skills and abilities will become qualified teachers who can prepare the children of the nation to face the challenges of the modern world.

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Making Connections With Curriculum: Introductory Technology Course Design

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Abstract: In many preserice education programs, students are only required to take one technology course which typically focus on procedural skills which are oftentimes not connected to or reinforced by other course work or field experiences. As a means of designing more holistic technology courses course developers must keep in mind the preservice student's focus: facilitating appropriate student learning experiences. After determining these, the teacher can best determine what tools and resources can help achieve instructional goals.

The much discussed push for integration of computers into the K-12 classroom requires that teacher education programs provide preservice teachers with hands-on and application-based experiences, and yet most programs teach "about technology as a separate subject, not teaching with technology across the curriculum" (Office of Technology Assessment, 1995, p. 165). Many programs require a computer science course while others offer education courses geared toward K-12 applications and software. Most of these courses focus on the acquisition of basic technical skills with some discussion of how technologies can be used to support learning. Most education programs, however, do not or have not demonstrated the transferability of these learnings from the college computer lab to the school classroom (Office of Technology Assessment, 5; Diegmueller, 1992). State and institutional standards for teacher competency in computer skills goes far beyond technical skills to include applications in problem solving and higher order thinking within in the disciplines. Yet most courses still focus on software-based procedural skills, such as: basic operating systems, word processing, desktop publishing, spreadsheet, database, Internet search engines, hypermedia stacks, and presentation software. More often than not preservice teachers are not provided an opportunity to apply these skills to a classroom setting or in other courses (Office of Technology Assessment, 1995). This paper describes an approach to technology course design that will foster the preservice teachers' ability to make connections among their academic experiences and enhance their ability to transfer skills to new settings.

Rationale

In order for preservice teachers to acquire and use technology skills it is critical to help them construct their own understanding of how technologies work as well as illustrate how it can be used. Many K-12 Schools have better and more current technologies than do schools of education (Office of Technology Assessment, 1995). Education faculty do typically do not model technology integration in methods and other required courses (Office of Technology Assessment, 1995) and yet students are engaged in a variety of activities that could be tied together through technology. Motivation for construction of technology knowledge comes from preservice teachers' interests which relate to their experiences outside of a given course and may be interests in other courses, children, field experiences, or memories of their own K-12 education.

Jonassen (1992) proposes that advanced knowledge acquisition is a primary goal of course work and requires complex situations in which learners can see larger connections and relationships among concepts. Cross-curriculum activities can provide this in education programs. Preservice teachers must be given opportunities to put together learning from different courses to get the big picture, especially within the disciplines (Thomas, Friske, Knezek, Taylor, Wiebe, & Sloan, 1994). Oftentimes course learning is isolated from the context in which it will be applied but we know important to situate learning in a context that mirrors the one in which skills will be applied (Roschell, 1996). Practitioners know that the typical school day involves cross disciplinary activities and decisions making that are not only complex but often require collaborative thinking and decision making although the college classroom experience often does not mirror or replicate this environment. Allowing students to make cross-curricular connections in their preservice program may serve as a facsimile or model of K-12 environments.

Cross-curriculum connections are not the only source of rich and complex contexts for advanced knowledge acquisition. The state of technology in education programs and in K-12 schools also provides disparate contexts for learning. Universities rarely have the same or approximate hardware and software as so K-12 schools and oftentimes, preservice teacher's' field placements are in low-SES schools with few and out-dated computers (Office of Technology Assessment, 1995;Chisholm, 1996; Committee for Economic Development, 1995). Regardless of the state of hardware and software, it is even more difficult to find field experience in which technology is being used to support learning in effective and meaningful ways. The status of technology in school may not be ideal but it is authentic and it allows students to construct a realistic understanding of what they can expect to encounter when they have opportunities to practice and eventually teach in the schools.

Goodlad's concept of an organizing center (p. 174) illustrates how a focus can provide a means to constructing an organizing element for course work. According to Goodlad, an organizing center comes from a student's experience or reading or viewing of materials. This focus must have meaning for the student and serve as a source of interest. All learners enter into a learning experience with different prior knowledge and beliefs. In order to start where the learner is, considering interests and background, it is necessary to allow the learner to make choices and decisions about some aspect of their course work.

These notions of experiential learning, making connections across the curriculum and organizing centers are all concepts that are discussed and implemented in the K-12 school system. If one goal of preservice programs is for teachers to integrate technology into the dynamic learning environment of the K-12 classroom, then modeling approaches that are used in that context in which technology is used as a tool to support learning rather than the only focus is appropriate. Therefore, technology courses may prove to be most effective when they are framed by curricular problems or situations from which technological applications and skills are derived.

Course Design

If education course work is to truly impact the learner, it is critical to begin with what the student knows, what they are interested in, and what they want and need to know.

Drawing upon the precepts described above, the following learning structures are used to design learning experiences in other disciplines and are well suited to preservice education courses. They allow for cross-curriculum connections, practical application, complex learning situations, and organizing foci that draw upon the learner's interests and experiences. They include case-based learning, problem-based learning; and theme-based curriculum. These are instructional and curricular designs that could be used in conjunction with other courses or as a device for drawing on field or course experiences without directly aligning those experiences.

Case-based learning focuses on cases that come from situations from the everyday world and are real and relevant to the learner (Shank & Cleary, 1994). A case should be used because it has some relevance historically or relation to a greater body of knowledge; is unique; or it is "paradigmatic," revealed through patterns of occurrences. In an educational technology course, a case might be based on a premise such as: telecommunication tools facilitate communication, decision-making, collaboration, and equalized participation among group members. From this cases are built. The instructor may choose to present a case or preservice teachers may create their own cases from field experiences, other course experiences, their personal histories, or readings. As these cases are analyzed and discussed learners will begin to generalize and explore new aspects of the case. In this manner they can seek out a variety of sources to answer questions or to illustrate their suppositions. Procedural skills are acquired as the class identifies the skills they have identified as critical to their process of analysis and eventual application of the larger ideas they are analyzing.

Problem-based learning is similar to case-based learning in that it draws upon a problem that is grounded in the real world. Students conclude their activities with by creating a product that illustrate their learning. Guzdial (1998) identifies three criteria for a successful, technology-based problem-based design:

- Students need opportunities to reflect on their learning and the purpose of the project.
- For learning to occur, student goals must be focused on learning or knowledge building.
- Enough support must be provided so that students can succeed (. 48).

In a preservice educational technology class, either teacher or students may identify a problem. For example, one question might be, how can the use of spreadsheets and databases best support learning? A more intriguing question for preservice teachers might be, what strategies can help me organize, communicate and retrieve what I am learning and observing more effectively? These questions allow for many avenues for investigation, among courses and in the field. They do not preclude direct instruction of procedural skills but create a situation in which students are motivated to learn them by their interests.

Theme-based learning centers around a concept or idea that is interdisciplinary in nature and allows for investigation of multiple topics in a variety of means and to a variety of ends. Gamburg, Kwak, Hutchings, and Altheim (1988) identify a theme study as an involved investigation on a topic of interest to the learner that is broad enough to address many subtopics. For the technology course, a theme might be generated from the content among several courses in the education program. Community, communication, structure, and exploration are examples of themes that could provide connections among a variety of field and course experiences. Students observing in an elementary school might find the theme of process helpful in making connections among their math and reading methods courses, technology course, and elementary lessons. Students at different grade levels and

disciplines could choose more specific sub-themes that tie into state essential learnings or school curriculum, such as production. The theme can provide a topic for projects as they investigate the content and see how it can be organized or illustrated using technology.

Case-based learning, problem-based learning, and theme-based curriculum are a point of departure for making cross-curricular connections. Faculty commitment to collaboration and alignment of course activities is critical. This does not mean that curriculum must be re-written but it must be re-conceptualized. The following illustrates how a technology course might be aligned with two preservice education courses.

Course	Traditional Activity	Aligned with Technology
General Methods	Creating an assessment instrument	Locating assessment instruments used by K-12 schools via the Internet:; creating rubrics on word processing software; posing drafts of instruments to a Web-based discussion area for feedback.
Literacy	Diagnosing reading problems	Creating hypermedia case studies; creating products to individualize reading materials for specific reading problems.

Table 1 Course Alignment.

Optimally technology courses should be aligned with a course that involves field experiences so that students can bring questions and information to course discussions. When the aligned courses are field-based processes are more holistic than if the technology course is field-based.

Conclusion

The ideas presented here are not novel or new to all education programs. They provide a way to look at technology courses in new ways that may help faculty better assist students in acquiring and applying technology skills in a variety of contexts and over a long period of time. Limitations of scheduling, faculty receptiveness, time, and program structure may infer with what and how technology learning is addressed in different institutions. However connections can be made among courses, even if they are generated by students and not faculty collaboration. One small correlation among course experiences may just open the door to a floodgate of others, once the opportunity is offered and intentional steps are taken.

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Solutions to Teaching Educational Technology Courses: A Case of Cross-Institutional Team Teaching

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Abstract: This paper describes a distinctive collaboration between two university faculty teaching educational technology classes at geographically distant institutions. Extending beyond a traditional model of collaboration through sharing resources, these faculty engaged in a unique form of team teaching that included "multiple concurrent experiments." Given the rapid pace of technological change and an awareness of the impossibility of keeping up, Ropp and Dickson developed an approach in which students and faculty from distant classes participated in and co-constructed the nature and content of these courses. Faculty used telecommunications to model pedagogical uses of technology for teaching, learning, and professional collaboration. In addition, evidence of students' work and learning became the substantive content of discussions and work in other classes through the publishing power of the World Wide Web. This approach to "virtual team teaching" shows potential for enriching and enhancing teacher education courses in a world of rapid technological innovation.

Introduction

The present work is an outgrowth of a National Science Foundation planning grant around a concern for preparing future faculty in higher education to use technology in their teaching. Prior to our current collaboration, we had conceptualized preparing future faculty as taking place through part of the doctoral program or, in some models, as a post-doctoral teaching fellowship. A review of the literature for this grant revealed that few programs concentrating on the preparation of faculty for higher education included teaching with technology as a major theme, and in many cases, it was not addressed at all. Our experience with this current work suggests that engaging new faculty and senior faculty in the effort of collaboratively constructing courses may provide an additional model for scaffolding higher education faculty in learning how to use technology in their teaching.

Objectives and Purposes

Almost anyone who has taught classes about and with educational technology has realized that the rapid pace of technological and information innovation provides additional challenges for teaching and learning. The purpose of this paper is to describe a unique approach to teaching educational technology courses in which faculty model and make visible the use of telecommunications technologies for collaborative teaching in this constantly changing domain in three ways. One element is using the power of emerging technologies like text-based chat and real-time video. A second is the sharing of resources through Web publishing and linking to participating classes. A third feature of this collaboration is the sharing of ideas between students in two different locations. In this manner, students can think about their

own work by realizing that teachers in other locations are struggling with the same issues. This approach is a dynamic work in progress that took place during the fall semester of 1998.

The Challenge

Using and teaching about educational technology is a genre of teaching that is fundamentally different from instruction in more traditional disciplines in terms of both pedagogical approaches and content. It is most often the case that students in educational technology courses arrive with an extremely diverse range of expertise, skills, and knowledge as well as cognitive and physical access to information technologies. Each semester of an educational technology course is a unique combination of individual students and their characteristics, the teaching and learning relationships developed during class, and the ever-changing window on the world of technology innovation that affects both substance and teaching style. In addition, finding and making available the educational resources that are newly emerging on the World Wide Web is a labor intensive endeavor and often there is no substantive reflection of that work beyond the boundaries of the learning that takes place during the semester.

Description of the Collaboration

Given the distinctive nature of teaching educational technology, two University faculty from different institutions have engaged this challenge by using telecommunications technology to team teach and share resources throughout the dynamic development of their courses. A major element of this approach is to model and make visible their collaboration to their teacher education students as an example of professional uses of technology for teaching. A second feature of this collaboration is to use the power of the World Wide Web to publish the resources created for teaching and to document evidence of student learning around those support materials.

During the fall semester of 1998, two faculty members at Michigan State University and the University of New Mexico were teaching very different courses in educational technology, yet they were able to share and adapt the resources they developed to enhance and enrich all of the classes. This collaborative effort involved a graduate course in human development and an introductory educational psychology course for undergraduates at Michigan State University. At the University of New Mexico, courses included an undergraduate survey class on computers in the schools and a graduate course about computers in the educational process.

In the weeks prior to the beginning of these classes, both faculty members established a familiarity with using "Instant Messenger," the free software application from America Online that supports "chat" interactions. During the day and some evenings, these faculty members used Instant Messenger to share the URL's of World Wide Web resources they discovered from exploration, online newspapers, print and text journals, and e-mail messages received from colleagues. Instant Messenger displays URL's as hypertext so Web sites are essentially a click away. Although the notion that faculty can share professional knowledge is not new and the Web is now a repository of related course syllabi, one of the most distinctive features of this collaboration is that Dickson and Ropp were co-constructing different but overlapping syllabi dynamically, in real-time, and sharing student work between the two campuses.

During the semester at both institutions, these faculty members incorporated most of the Web sites and information about recent print publications that they shared into continuously updated Web pages used for support of the classes. In addition, e-mail was a frequently used medium for providing information, links, and for submitting assignments and reflections to the faculty. As students became familiar with using technology to engage in learning activities between class meetings, they experienced more sophisticated uses of telecommunications for professional collaboration.

Toward the middle of the semester, students at the University of New Mexico prepared for a virtual visit from Dickson at Michigan State University. Students explored the LETSNet (Learning

Exchange for Teachers and Students using the Internet) Web project developed at Michigan State University and they ranked the "Big Ideas" around which it was organized. Half an hour before the teleconference, students entered their rankings using a dynamically updated database on the Web. Students and the long-distance faculty member at MSU were able to view the results of the survey online and they used the data to guide questions and discussion about this resource for using the Internet in the classroom.

During the telephone conference call, Dickson appeared via "WebCamToo," a freeware Web server application that allows users to put live video from an inexpensive Quick Cam video camera on a Web page and serve it to the Internet. At the same time, the faculty members initiated an Instant Messenger session and the active computer screen was projected on a big screen television monitor. Both faculty members had experimented with this inexpensive combination of videoconferencing and chat on a regular basis and students were able to experience a model of how educational technology might be used. Later in the session, Dickson shared excerpts of e-mail reflections from his undergraduate class on around the visit of 3rd grade students to their class. These undergraduates were responsible for setting up learning centers in the Technology Exploration Center at Michigan State University, guiding their young visitors through the learning activities, and then reflecting on that experience via e-mail. Dickson included these reflections at the bottom of his WebCamToo Web page so that the University of New Mexico students could read them. As he shared these reflections, Dickson engaged these master's degree students, whose ages ranged from 22 to 60 years, in a discussion of human development with respect to perceptions of technology in the field of education.

Near the end of the teleconference, Dickson talked about his recent search of the Internet for sources of information about Howard Gardner's theory of Multiple Intelligences for his human development class. He had just e-mailed the compilation of those online resources to his students and he emphasized the point that if his students had to buy books or a coursepak containing the materials that he had provided, it would have been over $40, yet anyone in the world could access these resources for free over the Internet. The next day, Ropp created a Web page for the UNM class with those links and included it in the class Web site.

At the same time, students in the University of New Mexico classes were developing major projects that incorporated educational technology into school curricula. Several of these students created educational Web sites that were focused on the purposes of supporting home and school communication, publishing students' work, and enriching classroom instruction with resources available only on the World Wide Web. Two days after these students had presented their project to their colleagues in New Mexico, Ropp gave students at Michigan State University a virtual tour of these Web sites during a videoconference session. At the University of New Mexico, Ropp had prepared a Web page that included live video of her served by WebCamToo. This Web page also featured links to the New Mexico teachers' newly created Web sites. During this audio and video-conferencing opportunity, Ropp described what the teachers had learned as they created their classroom Web sites and the fact that these teachers were now seen as "technology experts" by virtue of their coursework at UNM. This point was not lost on the Michigan State University students as Dickson initiated a discussion based on the observation that administrators and cooperating teachers often expect that students who have just completed teacher preparation at MSU are technology experts as well. Finally, Ropp shared with students the tremendous challenges and opportunities that make the New Mexico educational system unique in the country, and naturally quite different from Michigan.

Lessons Learned

In just a few short years, the Web has quickly and fundamentally transformed the commercial and private sectors and it is now beginning to make an impact in education. Prior to the Web, the possibilities of having students and faculty from geographically distant institutions see and *participate* in the uniquely constructed processes of teaching and learning in the classrooms of higher education was unimaginable.

Although the recent revolutions in telecommunications and computing have enabled tremendous new opportunities to enrich the educational process, they also have increased exponentially, the breadth and

depth of the content that might be taught in educational technology courses. It is possible that as far as we can see into the future, up to one third of a semester-long class might be dealing with content or processes that were not in existence the last time the course was taught. In light of these particular challenges and opportunities, part of what one might imagine with the kind of collaboration described in this paper is that more than one person might be working on the same problem, pedagogical approach, educational issue or software application. In this manner, collaborators essentially share the benefits of having two minds working on similar problems together.

Given the rapid pace of technological change, however, the reverse of this relationship is at once more interesting and more difficult to manage long distance. No one can possibly keep up with or know it all, thus we might take advantage of "multiple concurrent experiments." For example, Dickson this semester was experimenting with giving students in his class laptops, as part of MSU's deliberations on requiring laptops of all students by the year 2001. His experimentation in a course linked by collaboration with Ropp, provided her with a vivid window on this experiment and important insights into similar initiatives that might take place at the University of New Mexico. Similarly, Dickson learned from Ropp's experimentation with all of her students using and evaluating free e-mail accounts such as Yahoo mail. If each collaborator synthesizes new resources, develops pedagogical approaches for even one week of fifteen that are customarily taught, then students and faculty benefit from fresh perspectives they would not otherwise have. This kind of shared work might begin to approach the goal of trying to remain current in such a fluid and multifaceted field of study. The difficult element of this approach is that the collaborators need to have a strong relationship with each other and a level of trust that allows this kind of virtual team teaching. Precisely because you know the person well, you are more likely to take seriously and adopt the experimental practices of one another. That is, if each person is doing something different and experimenting, but you are close, it is as if you are developing the approach yourself. In light of the trust and shared visions of practice necessary to support this kind of collaboration, the issue of scalability merits further exploration and it remains to be seen if these relationships can be equally as viable with three, five, or more partners.

Implications for Education

This approach to virtual team teaching shows potential for enriching and enhancing teacher education courses in a world of rapid technological innovation in three important ways. First, college faculty must provide images of how educational technology can be used for teaching and learning by modeling its use inside and outside of the classroom (Office of Technology Assessment, 1995). Making visible collaborative teaching using educational technology enables this process to be an active, authentic, and natural part of instruction. Second, this approach of preserving evidence of the richness of teacher and student learning through Web publishing allows the artifacts of learning to be used for discussion within a class and in distant places. In this way, visible learning can promote self-reflection and goal setting for individuals, as well as provide educational resources for future classes in the same or other institutions. Third, to our knowledge, discourse about the value of online discussions of teaching have focused primarily on K-12 teachers. Our experience suggests that online discussion of teaching is equally applicable to higher education.

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Grounding the Educational Computing Course in Practice

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Abstract: This paper addresses reasons for grounding students' instructional experiences in a beginning educational computing course in practice. The author describes advantages for incorporating techniques from qualitative research into these experiences to sensitize students to effective uses of technology and to promote thinking about ways they will use technology in their classrooms. Examples of instructional experiences used by the author in a beginning educational computing course are included. These activities involve preservice teachers interacting with and providing resources for technology-using inservice teachers, children, and teacher education faculty.

Introduction

According to a study by the Educational Testing Service [ETS] in 1997, 98% of all schools own computers. Despite this large concentration of technology in schools, computers are at best a marginal activity in the classroom (U. S. Congress, Office of Technology Assessment [OTA] 1995). Kaye (1996) observed that even in classrooms with lots of computers and children using them, there is no guarantee that the children are doing anything of consequence with the computers. The classroom teacher determines what to do with computers placed in the classroom (Collis 1988; Cuban 1995; Martin 1991). Yet, most teachers report inadequate training on how to incorporate the technology into their teaching (Conte 1997; OTA). This statement applies to many of the new teachers entering the profession as well. "Overall teacher education programs in the United States do not prepare graduates to use technology as a teaching tool" (OTA, p.184). According to the OTA report, teaching tends to be about the technology rather than preparing teachers to integrate it into the curriculum.

The instructor of a beginning educational computing course faces many challenges when the course provides the first exposure for the majority of students in the course to many of the skills and concepts related to using and integrating technology into the curriculum. Students in this beginning course need to view technology within the context of teaching, not as a stand alone issue (Rodriguez 1996). One of the challenges this presents is "how to organize more effectively instructional experiences related to the understanding and use of technology in schools and classrooms" (Collis 1996, p. 534). This paper describes the development of instructional experiences designed to address this challenge in a beginning course required of all education majors at Harris-Stowe State College (HSSC). The goals of the course include the development of (a) skills necessary for using and integrating technologies in meaningful and relevant ways in educational settings, (b) an awareness of how technology can be used in schools and classrooms, and (c) a foundation for continued understanding of the implications and applications of technology in educational settings. The course incorporates collaborative, hands-on, and project-based activities with individual reflective activities.

Design of Experiences

Students' instructional experiences in this beginning educational computing course at HSSC are grounded in practice. In this context the word grounded is derived loosely from its meaning in qualitative research. Strauss and Corbin (1990) define a grounded theory as "one that is inductively derived from the study of the phenomenon it represents" (p. 23). A major reason for grounding experiences in practice in this course is

to provide opportunities for students to begin observing, questioning and reflecting on how teachers use technology. Through participation in experiences that involve the use of technology in actual educational settings, students begin gathering data to help them form their understanding of the role technology can play in educational settings. These techniques which are the same as those used in qualitative research studies are intended to sensitize students to effective uses of technology and to serve as a guide as they consider ways they will use technology within their classrooms.

Familiarity with related literature, professional experiences and personal experiences all contribute to the development of this sensitivity. A major thrust in this course is to provide students with background skills and information necessary to evaluate data they gather on the use of technology in schools. Just as in qualitative studies, students gather data from varied sources. These sources include observations from field experiences, discussions with practicing teachers, information gathered from electronic education-related mailing lists in which students participate, newspaper and magazine articles, and radio and television shows.

Personal experiences can sensitize students to issues surrounding the use of technology in the classroom. Activities designed to require students to demonstrate mastery of technological skills within meaningful contexts are frequently integrated into beginning educational computing courses. For example, students can demonstrate their proficiency with a presentation package, such as PowerPoint, by researching issues related to the use of technology in schools and use the presentation package as a tool in reporting their findings to the class. Students can show their ability to use HyperStudio by assisting children in the creation of classroom projects. While these activities are valuable in themselves, they can become vehicles for increasing students' sensitivity to the uses of technology when students stop to reflect on and discuss their experiences with technology in these contexts.

Examples of Instructional Experiences

What follows are descriptions of four instructional experiences which I use in my course at HSSC. The first two experiences address one of the major barriers to use of technology identified by both inservice teachers and teacher education faculty, limited time (Becker 1994; ETS 1997; Hadley & Sheingold 1993; Honey & Moeller 1990; OTA 1995; Szabo 1997). These activities provide students in the computing course with a meaningful context in which to select and evaluate software and Internet resources for use in the classroom. The second two experiences involve my students interacting directly with children using technology at a technology-rich partner school.

Keeping Up with Technology Newsletter

Students in each section of the beginning course taught by the author produce a newsletter, Keeping Up with Technology. The newsletter contains recommendations on software, Internet resources and news about instructional technology. The newsletter is designed to provide a quick resource for members of the teacher education faculty for finding technology materials to use in methods courses. Students locate, evaluate, and write a brief description of the best resources they have identified as being of use to members of the teacher education faculty and interested teachers at partner schools. To encourage busy faculty members to explore the resources in Keeping Up with Technology, each issue is restricted to two sides of an 8x11 page. The name is the only constant as students in each section determine the format and content of the newsletter. Newsletters have contained reviews of software available in the college's Media Lab, descriptions of listservs the students have found particularly helpful along with information on how to join the listservs, technology news, and information on educational web sites. Members of the teacher education faculty report that they have used information from the newsletter directly in methods classes and indirectly for professional purposes and class preparation. The web sites are particularly popular. Because students in the computing class often first encounter the newsletter in methods classes, they are aware of the role it plays in promoting integration of technology resources in other classes.

Internet Resource Locators

A second project undertaken by students in the course is serving as Internet resource locators (IRL) for teachers at a partner school. This experience evolved out of a conversation with a teacher at the partner school. The teacher explained that while she could see a use for many resources available on the Internet, she simply did not have the time to locate them for inclusion in her lessons. Teachers initiate requests by emailing me themes and grade levels for which they need resources. I relay the request to students in my course. The students proceed to locate and evaluate sites related to the themes. They review each site for suitability and reliability of the content, and to determine whether the level of the site is appropriate for use with students in the target grades. Once students have identified a collection of sites they believe meet the teachers' specifications, they use the on-line resource, Filamentality (www.kn.pacbell.com/wired/fil/), to create on-line hotlists so the classroom teachers can easily check the sites when they have time. Classroom teachers are given the passwords and login names needed to access the lists of sites so they can use the sites in developing instructional activities for their students. In return, when a teacher has created lessons using the web sites found through the IRL project, the teacher shares the activities they have created with the educational computing students. In some cases, lessons have been made available to the college students through the partner school's web site. This enables the students who have located the sites see how an experienced teacher incorporates the resources into instructional activities. This is the third semester that students in the educational computing class have located Internet resources for the teachers at the partner school, and the service is currently being extended to additional schools with which the college has formed partnerships. Plans are currently underway to add one final activity to this experience. Teachers at the partner school have suggested that the college students work with the children at the elementary school when the children participate in the lessons designed with the web sites found by the college students.

Interactions at Technology Rich School

My students have opportunities to interact with teachers, students and administrators during at least two sessions held at the partner school. The Instructional Coordinator at the school meets with the students to discuss ways technologies are infused throughout thematic units used for instruction at the school. She guides them through the process of creating thematic units and shares with them examples of thematic units developed by the school staff. The preservice teachers engage in a variety of other activities while at the school. They learn to use new software packages together with children, assist children using computers, participate in discussions with the computer lab teacher about his role in supporting the classroom teachers, and explore the software available at the school. Following experiences at the school, the college students write reflection papers in which they describe what happened during the visits, and what they learned about children using computers. Many of the students in my class will return to this school for their student teaching experience.

Creation and Implementation of Thematic Units

Students in this course have developed a thematic unit on Cinco de Mayo and invited fourth grade students from a partner school to visit the college to participate in the activities designed as part of the unit. The fourth grade students participated in an Internet scavenger hunt designed to acquaint them with the customs and history of Cinco de Mayo, related story-telling, geography and art activities, and tasted Mexican cookies. Development of this unit provided a meaningful context for students to raise questions concerning whether the integration of technology enhanced the unit and to use skills and information from the educational computing course to produce materials. Reflections on the completed experience gave students an opportunity to continue to evaluate the role of technology in this educational activity.

Summary

The projects described in this paper are examples of experiences related to the practice of teaching that can be incorporated into a beginning educational computing class. These experiences provide a meaningful context for students to use the skills and information they have been learning in the computing class. They also provide an opportunity for students to use techniques from qualitative research as they collect data, raise questions and reflect upon their experiences with technologies in educational settings. The inclusion of these

techniques from qualitative research is designed to increase students' sensitivity to ways technology might be used in the classroom and to contribute to students' development of a personal philosophy regarding the role technology will play in their classrooms. Hopefully, it will not be a marginal role.

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Design for Transforming: Multimedia Projects in a Preservice Educational Computing Course

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Abstract: This paper reported an experimental multimedia project in a preservice teacher education course. The multimedia project was aligned with the critical pedagogy in cultivating transformative intellectuals. Participants of the project investigated critical issues in their communities and presented their projects by using a multimedia tool. By doing this project, students developed their awareness of critical issues in their communities and the role educators could play in changing the situation. It was found that technology sustained students' motivation and interest, enhanced the challenge of the project and unleashed students' creativity. The paper argues that technology can be a powerful tool in support of the pursuit of transformative pedagogy.

Introduction

I teach instructional technology at the University of Guam. The majority of my students are education majors, with a few from other departments such as business, psychology, political science, and English. In my class, students learned the use of the computer as well as its applications in classroom teaching. However, I was bothered by one assignment - multimedia project. For this assignment, students were required to create something they could use in classroom teaching by using a piece of multimedia software, *hyperstudio*. Frequently, student projects lacked depth. Their multimedia stacks were superficial, just dotted with bells and whistles. Worse, some of the students simply copied from textbooks and translated text format into its electronic format. Why such a powerful technology led students to passivity rather than creativity? I reacted to students' projects with similar passivity; going over the projects in a routine manner of assigning grades and at the same time, feeling bored to death, viewing these projects.

This experience led me to search for alternative approaches. In this process, I became particularly interested in "transformative pedagogy." Transformative pedagogy considers the goal of education is to instill critical citizenship into students and prepare them for the role of transformative intellectuals. Transformative intellectuals are responsible and active citizens in communities, who take an active role in transforming the society through various forms of democratic participation and social action (Giroux & Mclaren, 1986; Cummins & Dennis, 1995). In classroom learning and curriculum organization, transformative pedagogy advocates collaborative critical inquiry. "Transformative pedagogy uses collaborative critical inquiry to relate curriculum content to students' individual and collective experience and to analyze broader social issues relevant to their lives (Cummins & Dennis, 1995; p. 153). Freire's approach in literacy education is an exemplary example of utilizing literacy acquisition as a means to transform learners into change agents of social realities (Freire, 1989).

Transformative pedagogy makes me view technology learning from a new perspective. As critical literacy acquisition, could I find a way to relate technology learning to students' personal and collective experience? Would it be possible to embed technology learning in a meaningful context? Could technology play a role in preparing students to be transformative intellectuals? With these questions in my mind, I redesigned the multimedia assignment for my course. Students would jointly investigate critical issues on Guam and develop curriculum integrating these issues. They would design and present their projects by using a multimedia tool.

Literature Review

Instructional Technology (IT) has had a long involvement with learning theories. There has been an overwhelming amount of discussion on the role of technology to support the pursuit of a certain learning theory, from behaviorism to constructivism, with a host of other concurrent learning theories such as problem-based learning, project-based learning, situated learning, anchored learning, and contexted learning; to name just a few.

Learning theories provided a psychological basis for IT learning. However, education is not merely a psychological process. "Education either functions as an instrument to facilitate the integration of the younger generation into the logic of the present system and bring about conformity to it, or it becomes the means by which men and women deal critically and creatively with reality and discover how to participate in the transformation of their world" (Shaull, 1989; p.15).

Early in the century, John Dewey (1968) warned that schools should not merely become an adjunct to the society. There is a standing danger that "Education would then become an instrument of perpetuating unchanged the existing industrial order of society, instead of operating as a means of its transformation" (p. 316). However, "the capturing of educational discourse by psychology has markedly weakened our ability to respond to the crisis as something that is of crucial importance in an education worthy of its name" (Apple, 1986; p. 4).

"There is no such thing as a *neutral* educational process" (Shaull, 1989; p.15). Education serves the human society as an essential ideological instrument. History taught us a bloody and costly lesson "when in 1935, the great trainer Hitler whistled his commands, a hundred thousand obedient, fawning dogs wag their tails in the Templehof, Berlin" (Neill, 1960; p. 100).

School routinely ignores the social and political aspect of learning. Current school curriculum fails to provide meaningful connection between classroom learning and the real life students are living. "The result of this disparity between the nature of schools and the students who attend them is disaffection, apathy, and failure" (Mason, 1996; p. 265). Advin Toffler (1980), the author of the landmark book *The Third Wave*, pointed out that current education in schools is out of touch with a society exploding with complexity. "Most students have no conception of the architecture of their own city's economy, or the way the local bureaucracy operates, or the place to go to lodge a complaint against a merchant. Most do not even understand how their own schools-even universities-are structured, let alone how much structures are changing under the impact of the Third Wave" (p. 377).

Teacher education plays an essential role in cultivating transformative intellectuals. The goal of teacher education is not merely helping prospective teachers to become experts in subject matters, but also helping them to develop democratic and critical perspectives on education. However, there has been a trend to confine teacher education narrowly to content knowledge (Pietig, 1997). Goldman and Fish (1997) interviewed 15 students in teacher education on the issue of social equity, only five of them thought the concern of social equity would be at the center of their teaching. "Most university coursework emphasized progressive educational views but contained little about the social and political implications of education" (Goldman & Fish, 1997; p. 101).

Teacher education can no longer remain unconcerned with preparing students to be transformative intellectuals. This goal needs to be integrated into teacher education curriculum and addressed explicitly. As curriculum is by no means politically neutral, neither is technology. Technology can be used to support the pursuit of one form of pedagogy or another. This study explored the role of technology in support of the pursuit of transformative pedagogy.

About Guam

The island of Guam is a U.S. territory in the Western Pacific Rim, between Hawaii and Philippines. Guam is the largest and most populated of the Marianas islands. Guam is about thirty miles long and eight miles wide with a population of 146,000. "Guam's political status as an American territory and its pivotal role in Pacific

transportation and communications have made Guam economically and socially distinct from its Micronesian neighbors" (Schmitz & Pono, 1995; p. 62).

Methodology

Data collection covered a period of six semesters with about 150 participants. The multimedia project lasted for about 3 weeks each semester. Students investigated critical issues on Guam and presented their findings using a multimedia tool. To mitigate researcher/instructor bias, data were collected from multiple sources; classroom observation, interviews, and evaluation of students' multimedia projects.

Findings

A variety of topics emerged; traffic accidents, drug abuse, teenage smoking, domestic violence, child abuse, AIDS on Guam, young gangs, graffiti, teenage pregnancy, recycling, water resources, and student dropouts. Students' research alarmed the class, revealing a community plagued with serious problems. For example, in 1997, there were 9674 traffic accidents on the Guam. Over half of the traffic fatalities were alcohol related. Drug abuse is rapidly increasing, affecting four out of five families. There are about 15,000 ice users on Guam. Police arrested more than 300 ice users in 1997 compared with less than 100 in 1993. The youngest ice addict was 8 years old. At least 10% of teenage girls get pregnant each year, and 90% of them were not married. Guam's major landfill exceeded its life span three or four years ago, but the government could not close the facility without a new, sanitary landfill to accept the island's garbage. The overflowing landfill has contaminated the river and breeds rats, flies and other pests.

Students' Awareness

As students researched their topics, they became keenly aware of the seriousness of these issues. As one student put it: "Well, we did not know that drug issue was so critical, we knew there was a concern. But when we look at statistical data, that's when we were overwhelmed. When we did research, we found it was a very crucial area."

Students' concern for their community became the driving force for them to carry out their projects. Fueled with this motivation, students were willing to invest their time and efforts. "You are doing a service for the community by doing something like this, and you understand where you live and plus you can get the information back to your community, which is a good thing. At least, you know, give something back to the community."

Students felt they were deeply involved in this research project because they were investigating issues that were crucial and relevant to themselves, their family members, and their community. "These issues affect everybody." One group of students investigated AIDS on Guam. When they showed the class the data about AIDS on Guam, they told the class: "Don't think of this only as statistics, think of them as human beings with flesh and blood. They can be your cousins, your friends and your family members."

Get to Know the Issue Well

Students worked hard to understand the investigated issues. Their research went into depth. They studied the literature of these issues to bring a historical perspective into their research. What was the first case of AIDS? When was the first publicized document on danger of smoking? One group found an article on the Internet on traffic accidents which they felt very informative. They quoted: "The first death I caused was the death of Mr. Henry H. Bliss, a real estate broker, in New York, September 13, 1899. Since that first recorded death, I have been responsible for twice as many deaths as all of the wars in which the United States has been involved."

Students visited different agencies, organizations and schools to bring multiple perspectives into their research. They surveyed school students to find out their perspectives on these issues. "What we thought was the main reason for kids to do graffiti was not their reason. They gave us the whole bunch of different reasons. It was interesting, because we finally realized that it is not just the issue that kids were bad. We found that from their perspectives, they were just bored. They just want to go there and do something. That ties in to the community and school to offer some activities for kids, or something kids can help with."

Students interviewed school counselors, teachers, parents, former gang members, former drug addicts, former drug dealers, teenage mothers, school dropouts, law enforcement officers, village mayors, and community people to listen to their voices. Here are some excerpts from their interviews.

> I found out in High School that it is better to make a friend than an enemy. I realized if they (gang) really wanted to be my friend that I didn't have to do all the things that they did (drugs). (former gang member)
>
> I quit school because I always fought with my classmates. There was no one to be friend with because they were all from Guam, and they thought they are perfect. Because I was brown and I did not wear fancy clothes, they do not like me. They laughed at my English sometimes. I do not care because I was smarter, but they only hurt my feelings and I was left out. I told my mom about this and she kept telling me to go back to school. To ignore them and study, However, I can't, I really was willing to stab someone. Luckily my teacher found my small knife in my pocket. (High School Dropout)
>
> Wait till you are much older. It is very hard having a baby because you don't have a job to support your baby and yourself. (Teenage mother)
>
> My advice to kids is don't do it, it is not worth it. Stay off of it. Listen to what everybody is saying. It is physically bad for you and it deteriorates your body. (former drug dealer)
>
> I can only say, don't give in to peer pressure. If you are curious like I was, the best way to find out is to read about it. Also, don't associate with people who might be doing drugs. Stay away. (former drug user)

Educators' Role

Students highly agreed that they need to raise the awareness of Guam communities on these issues. They commented:

> "I don't think there is enough awareness of these critical issues in our communities. We should always instill that in our students that these issues are on us and they should always be aware of them."
>
> Students need to be given to exposure to know about their environment, learn that these issues are happening around them, and ... know the different agencies or the people they could go to get help -- even just discuss the issue, you know, it makes difference
>
> I feel that you need to educate them when they are young. You can start at elementary and educate them that AIDS is bad. Some teachers shy away from it. If you start to teach them at a young age, even at elementary school, they will grow with that perspective. I don't think they instruct that at any schools here.

Students suggested school and classroom activities to teach these issues. For example, teachers can invite guest speakers, such as former drug users, former gang members to talk about the issues; organize fund-raising to help recycling; take children to a field trip to help clean up graffiti, to interview maintenance workers about his/her feelings on cleaning up graffiti; organize AIDS Awareness Week, Red Ribbon Week, AIDS candle light night.

Students included ideas in their projects to integrate these issues into the curriculum. Drugs, smoking, AIDS, teenage pregnancy can be integrated into health science class. In art class, students can design AIDS quilt; for recycling, students can make bottle vases using used bottles and magazines. One group of students showed the class the bottle vase they made. It was a piece of colorful and beautiful artwork. Another group of students expanded that idea of making bottle vases. They suggested that students could actually put photos of the classmates around the vase to make it memorable. In language arts class, students can write poems, journals,

stories and papers on these critical issues. One group included a sample of poems they wrote to demonstrate the power of poems in educating students on these issues. They wrote "Eulogy to a Smoker" and "Ode to a Smoker", which were full of humor and wit. Creative alphabet writing integrate these issues into literacy development. For example, A is for Abstinence, B is for Blood. E is for Education, I is for Immune System. J is for "Just say No. Teachers can create word puzzles to ask students to identify body parts that can be affected by drug abuse. In math class, recycled cans can be used to practice student counting skills.

Technology's Role

Multimedia - the Right Way!

Technology supported students both affectively and cognitively. Technology sustained students' motivation and interest, enhanced the challenge of the project, provided access to information, unleashed students' creativity and fostered students' self-esteem and self-confidence. Here are some comments from students:

> I think the most exciting part was to put it in the computer and use all these design such as animation, sound, and everything. That's the part we like the best. Everybody was enjoying it. Especially with the poem we had, we want it to hit our audience, we want our audience to feel the pain.
>
> It is better for our project to be presented as multimedia. We want our project to be appealing. As the person [the user] goes through the cards, he is being introduced to the information and they need to interact with the program, so it gets them to be involved, and I think that will make the person get the point of the stack, because they are interacting with it.
>
> I like multimedia. The project is informative. If you use it in school, students will have fun clicking on it. They will like it. They like the sound and the music. They will enjoy using it because it is not boring. It is not like, open your book to page five and read what AIDS is. It is not just books.

Developing Higher Order Thinking Skills

Producing a multimedia product is a highly cognitive process. "Our belief is that producing hypermedia and multimedia products is among the most complete and engaging of the constructivist/constructionist activities (Jonassen 1996, p. 94). In a multimedia environment, information can be organized in a non-linear and non-sequential way, which is called "hypertext". That challenged students to break away from traditional linear and sequential thinking processes and presenting modes. Students need to identify the relationship between information so that they could link them in a meaningful way. Hypertext served as an advanced organizer structuring students' thinking process. It helped students organize their thinking and explore the issues at a deeper level to find out logical connections between pieces of information, thus practicing their higher order thinking skills.

Design and Creativity

Multimedia provided multiple and active mode to represent students' ideas. Students could utilize music, graphics, animation, and video clips to communicate their ideas and their emotions as well. With great interest, students worked hard on their design, often going into detail. Students evaluated a graphic, a color, a sound, a font, and a button icon in the light of whether its use would enhance the quality of their presentation. No longer did they treat these resources as bells and whistles. They are there to convey meanings: pictures of traffic accidents, voice of a AIDS victim, a video clip of a Guam overflowing landfill. Everything was charged with meaning. Students were willing to take the risk in experimenting different designs, trying out alternatives until they were satisfied with the effect.

The group who studied teenage smoking used a graphic of a skeleton as a major button icon. They also input a hysterical coughing sound into the icon. The user can hear the hysterical coughing each time she/he clicks on the button to navigate through the stack. The recycling group chose to use a globe as a major navigation button

icon, reminding the user the importance of protecting our environment. Driving Under Influence group used the song at Princess Diana's funeral as closing music. The whole class felt silent when a poem scrolled up the screen and the song started to play. As one of the presenters put it: "We decided to use it because that was a strong song, especially for Princess Di. Everybody remembers her so if they hear the song, they know what to think. They know her driver was drunk."

By doing the project, students learned technology well. They told me: "We learned by hands-on experience." "Now I can use this piece of software to create anything, it is just a piece of cake for me." What was more important, they learned how to apply technology in a meaningful way. "It will be boring if you just learn computer itself. It is better to integrate other types of learning. That is what education is all about."

Self-Esteem and Self-Confidence

Technology played a major role in fostering student self-esteem and self-confidence. Students' responses were overwhelming:

> I think the pleasant thing was that being able to create something using computers, that was the thing that makes us feel good because you are creating something on your own, and it is like, that is mine, I did that.
>
> Well, today I did not think I would be this satisfied. But when you got the your presentation, boy, you are just going to be in another cloud. It is really good feeling to be able to do something and say, I did that.
>
> It is just feels good presenting our project. Then there is a sense of accomplishment. When you look at your project, you just kind of say to yourself, I did this, our group did this. And it is such a meaningful project.

Conclusion

I'd like to use an incident as the conclusion of this paper. One day, as I was on my way to the office, I noticed a group of students were campaigning for AIDS awareness on the campus. They set up a table and pass information and red ribbons to passers-by. As I came closer, I recognized they were students in my class, now doing AIDS projects. They pinned a red ribbon on the collar of my dress, which I wore for many, many days.

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Evaluating the Computer Competency of Preservice and Inservice Educators

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We live in a world that is inundated with technology. Every time we turn around, it seems as if we see an Internet address. URLs (uniform resource locators) such as http://www... appear on our TV screens, monthly bank statements, billboards, in local newspapers, magazines, and even in local grocery store flyers. Federal and state agencies are mandating technology competence in educators in response to the demands of the information age. Many school districts and teacher education programs are grappling with two basic dilemmas: How do we determine what skills constitute technology competence, and how do we measure competency once we determine these skills? This demonstration focused on both issues by presenting a step-by-step account of the development of a computer competency test developed by the author for the College of Education at the University of Texas in Austin. Topics presented included: determining the objectives, preparing the test, field testing, and implementation.

Transforming Instructional Technology 101 into a WebQuest!

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Abstract: This paper is to demonstrate how this professor converted a traditional, directed/constructivist course into an on-line, hands-on, team-oriented, student-centered, product-developed course designed for pre-service teachers. Three years ago, the course curriculum was initiated from a teacher-centered perspective. As technology evolved, the course evolved. Changes took place, which included moving from a hard copy portfolio to an electronic portfolio, and online submission of projects. But the outcomes of the course, although electronic, were teacher-initiated. After the instructor investigated the concept of WebQuests, an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web, the course evolved into this constructivist method of instruction. Comparisons in the two course structures are analyzed and the results are presented.

Introduction

What does the word WebQuest imply? Could it be questions about the Web, questions from the Web, or researching the Web to answer a question? If you chose the latter, you were correct. A WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to use learners' time well, to focus on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis and evaluation. The model was developed in early 1995 at San Diego State University by Bernie Dodge and Tom March. Dodge (1997) outlined the model in the World Wide Web document, "Some Thoughts About WebQuests".

This paper is to demonstrate how this instructor converted a traditional, instructivist/constructivist course into an online, hands-on, team-oriented, student-centered, product-developed course designed for pre-service teachers using the WebQuest concept. Comparisons in the two course structures are analyzed and the results are presented.

In the fall of 1996, the course curriculum was initiated from a teacher-centered perspective. The curriculum was developed from models of similar courses, from the criteria from the General Competencies for Licensure and Certification by the Oklahoma State Department of Education, from National Council for the Accreditation of Teacher Education (NCATE) accreditation standards, and from practical application from faculty members' experience. As the course evolved, changes took place, which included moving from a hard copy portfolio to an electronic portfolio and online submission of projects. But the outcomes of the course, although electronic, were teacher-initiated. After the instructor investigated the concept of WebQuests and observed student motivation using this method, the course evolved into this constructivist method of instruction.

The course, Technology in Education, is taught in a regional university with a student population of about 9,000 in northeastern Oklahoma. The uniqueness of this university is based upon the fact that it has the largest Native American student population than any in the nation and graduates more teachers of Native American students than any in the nation. EDUC 4823, Technology in Education, is required for education majors and meets the standards set by the state of Oklahoma and National Council for the Accreditation of Teacher Education (NCATE).

The value placed on technology use is evident in the NSU College of Education's Conceptual Framework. The College of Education advances the quality of educational experience for all learners through

programs that value "an understanding of educational technology and how it enhances the ability of the professional educator in the teaching and learning processes as a teaching tool".

Why Transform?

In the fall of 1996 students were handed a syllabus that fragmented the concepts and skills to be experienced by the student. Strategies employed were a mix of instructivist and constructivist. The concepts addressed were competencies in word processing, spreadsheet, database, CAI, software criteria for evaluation, presentation software, and telecommunications. Infusion of technology was the underlying theme of each project with students reflecting on their own content area. Different learning theory approaches were interwoven into class discussion. The concepts were approached from two avenues, productivity and instructional. For example, the first project would require students to address how word processing would be used for classroom management as well as how word processing would be used for instructional purposes. Students were given criteria for project completion for each concept, i.e., a lesson plan created in Microsoft Word using specific features of the program. The plan was to include how their students would use word processing in a lesson application. A pre-service teacher might create a lesson plan that would require their students to apply word processing to research reports on a current science investigation. Each project addressed the specific concepts in a similar way.

By the time the pre-service teachers reached the telecommunications project at the end of the semester, computer anxiety had diminished and only procrastinators suffered with the lack of time anxiety. Students were already e-mailing the instructor in the form of an e-journal reflecting on learning experiences, so, as a part of the telecommunications project, they joined listservs, searched the Web, and created a personal web page.

The completion of assignments addressed each concept with a specific set of criteria for assessment. All projects were to be submitted as a portfolio at mid-term and at the conclusion of the course. An electronic portfolio was submitted along with hard copies of the projects.

The first year student evaluations were for the most part positive, with most negative comments addressed to the topic of the course scope being too broad. Since this is the only technology course for pre-service teachers, the wider scope was justified as an introductory course giving the learner an overview of instructional technology. Based on student demand, steps are currently being taken to add courses which will allow for more in-depth study.

Course objectives for the second year were the same as the first year, with refinement to the application of topics covered. The topics were still approached from the productivity view as well as instructional view. For example, students created instructional material using word processing from the productivity view and e-mailed the instructor specifics on infusing word processing into any given lesson in their content area.

No projects in the course in the second year were directed from a non-instructional application. The telecommunications project changed from creating a personal web page to creating a web page for instructional purposes. During this time period, WebQuests were discovered while using Kathy Schrock's Guide for Educators on the World Wide Web at http://www.capecod.net/schrockguide. During the summer of 1998, the concept of WebQuests were introduced and pre-service teachers created their first.

Also, during the fall of 1998, faculty of the College of Education at NSU observed student sophistication increase in the use of computers. This was partly due to a recently implemented required basic computer course for entering freshmen. This increased computer confidence of education students encouraged faculty to address the need for more student responsibility in building their knowledge base for becoming technologically efficient facilitators of instruction. As a result of this observation as well as observing the excitement in discovery learning and the pride in synthesis of that learning, a course based on inquiry evolved. The WebQuest provided an intriguing mode of delivery.

Why is This WebQuest Unique?

Although the majority of WebQuests have been created for elementary through secondary, this course is one that is created for higher education. The instructional goal of a longer term WebQuest is what Marzana (1988) calls Dimension 3: extending and refining knowledge. After completing a longer term WebQuest, a learner would have analyzed a body of knowledge deeply, transformed it in some way, and demonstrated an understanding of the material by creating something that others can respond to, online or off. A longer term WebQuest will typically take between one week and a month in a classroom setting. This WebQuest is designed for a length of one semester or 16 weeks.

The WebQuest Course Design

WebQuests of either short or long duration are deliberately designed to make the best use of a learner's time. There is questionable educational benefit in having learners surfing the net without a clear task in mind. To achieve that efficiency and clarity of purpose, WebQuests provide structure through an introduction, task, process/organization, information sources, evaluation, and conclusion.

Introduction

According to Bernie Dodge in Building Blocks of a WebQuest (1997), the purpose of the Introduction section of a WebQuest is two fold: first, it's to orient the learner as to what is coming. Secondly, it should raise some interest in the learner through a variety of means. It can do this by making the topic seem...

- relevant to the learner's past experience
- relevant to the learner's future goals
- attractive, visually interesting
- important because of its global implications
- urgent, because of the need for a timely solution
- fun, because the learner will be playing a role or creating a product.

The WebQuest for Technology in Education, introduces pre-service teachers to the need for the on-going quest to continually learn new skills to infuse better technological strategies into the curriculum in order to better serve their students in the 21st century. Links to web sites point students to the results of this research.

Task

The task is doable and interesting, describing what the learner will have done at the conclusion of the quest. The task for each team of pre-service teachers begins with an appointment by the Governor of Oklahoma to a task force whose charge is to build and implement a training program for other teachers in their district. This training program will assist the teachers in their district to infuse technology into the teaching and learning process. This journey will begin by investigating the competencies of instructional technology from a national and state level. Sources are used such as state departments of education, National Council for the Accreditation of Teacher Education (NCATE), U.S. Department of Education, and learned societies. From these points, students will determine the method they will use to demonstrate mastery for these competencies. A needs assessment of skills and knowledge for each pre-service teacher is proposed to determine the scope and sequence of the content. They will decide, for example, how to teach others the need for and the use of productivity tools for word processing, database management, and spreadsheet applications.

Each team member will be assigned a role of expertise on their committee that will assist their team to reach the mastery level of competencies. The roles include experts in areas such as learning theory, teacher productivity applications, curriculum integration or instructional software, on-line learning, and ethical and social implications of educational computing. The roles may vary based on number of team members and the scope and sequence of tasks undertaken. Each team is encouraged to go in as much depth in the research and

development of the task as time allows. The instructor serves as guide and facilitator throughout the entire process.

Process and Organization

A description of the process is provided for the learner to accomplish the task. The process is broken out into clearly described steps. The steps include guided questions, challenges, directions to complete organizational frameworks such as timelines, concept maps, and cause-and-effect diagrams. This is the place used to provide learning advice and interpersonal process advice, such as how to conduct a brainstorming session. The task describes what the learners are to do and the process describes how they might go about doing it.

For example, the Technology in Education WebQuest process guides students through organization of group roles and tasks, setting up the group management system, organizing for the assessment, creating an action plan, searching the collection, gathering the data, providing both technical and pedagogical instruction for each member, creating the learning product, building accountability of each team member for all aspects of the team's mission, and administering the learning product to practicing teachers.

Information Sources

A set of information sources is needed to complete the task. Many (though not all) of the resources are embedded in the WebQuest document itself as anchors pointing to information on the World Wide Web. The information sources are web documents, searchable databases on the net, experts available via e-mail or real-time conference, and books and other documents physically available to the learner. Because links to resources are included, the learners are not left to wander through webspace completely adrift.

The sources are provided for infusing technology into the curriculum from an instructional view and a productivity view. For example, upon approaching the instructional point of view, links take students to web documents that detail criteria of learning theory, instructional design, software evaluation, web site evaluation, multimedia authoring tools, and downloading instructions for instructional software to evaluate.

Sources from the productivity view guide students into the use of tools needed for better classroom management, i.e., word processing, spreadsheet, database, presentation, graphics, grade books, and test generators. The team members who have assumed the roles of experts in the fields of instructional and productivity software are encouraged to provide additional resources for additional information and training for their team members.

Evaluation

Each team member will achieve mastery of the competencies and will in turn be able to conduct an in-service session for any of the competencies. During the needs assessment development, the team will determine the scope and sequence of the competencies. During the evaluation process, team members will demonstrate achievement of their team's criteria for mastery.

The performance assessment takes place in an instructional setting for teams to teach the skills they have mastered and to demonstrate the instructional materials developed. Reflection will be a part of the assessment which will remind pre-service teachers of what they have learned throughout the process, and will encourage them to extend the experience into other domains. Students will submit all learning materials, both printed and electronic for their assessment.

Assessment of the Course

Student evaluation of the course is used throughout the semester for follow up and modification. Students in the fall of 1998 were asked to complete a questionnaire that assessed attitudes about this method of instruction. Data from the December surveys will be analyzed to determine if experience in an inquiry-driven course creates a more favorable attitude. The faculty members of NSU College of Education developed the questionnaire. This method of instruction has been in place for one semester; therefore, it is continuously monitored for success, through informal and formal feedback. Informally, students are excited about this approach to teaching and learning, can see the value of constructivist strategies, and are able to transfer this knowledge to their future endeavors in the educational setting.

Conclusions

By experiencing the acquisition of knowledge on a need to know basis, by attaching the relevance to their professional goals, and by using teamwork and authentic assessment through a task that is interesting and fun, these pre-service teachers leave EDUC 4823 with the tools and hands-on experience for lifelong learning. From year to year or possibly from month to month, technology will change, therefore, competencies for using technology in instruction will change. The 1996 students of EDUC 4823, Technology in Education, would find different outcomes of this course content, as it should be. For we are the role models for those new change agents in educational settings. And the change agents, our students, will need to learn the methods for continual learning in the 21st century.

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Are Educational Computing Courses Effective? Teachers are Talking

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Abstract: This study examined the effectiveness of an educational computing course on preservice teachers' computer use and attitudes toward computers in education. The study used data from 16 (12 female, 4 male) preservice teachers who attended the University of Southern California. Results indicated that teachers' prior computer experience shapes their expectations from the course. Teachers reported that having a home computer, professor's willingness to teach, and the current utilization of technology in the schools at which they work also had influence on their attitudes toward computers and their computer use.

Introduction

It is obvious that information and its technologies will dominate the 21st century. Computer technologies are playing important and essential roles in education because of their tremendous potential for teaching and learning. Therefore, it is critical for individuals to have the necessary education and skills to compete in the next information dominated century. Similarly, teachers also should be capable of conveying computer skills to students in the classroom.

In most teacher education institutions, computer specific courses are offered as an initial attempt to prepare a student teacher's future in computer technologies. In fact, most states require pre-service and in-service teachers to take a computer literacy course while fulfilling the requirements for a teaching credential. These courses are usually designed to teach basic computer skills and to introduce teachers to several commonly used computer applications such as word processing, spreadsheet, databases, telecommunications, presentation programs, and integration of these applications into the classroom. These courses are intended to provide pre-service and in-service teachers with more hands-on experiences so that they can integrate computer technologies into their teaching practices.

A large body of literature supports the idea that the biggest obstacle to teachers using technology in their classrooms is the lack of adequate teacher training (Brooks & Kopp, 1990; Ingram, 1992; Beaver, 1992; Vagle & College, 1995). Perkins (1992), for example, pointed out that teachers are not being adequately prepared for the challenges of the next century: ". . . students are learning and teachers are teaching in much the same way they did twenty or even fifty years ago. In the age of CDs and VCRs, communication satellites and laptop computers, education remains by and large a traditional craft." (p. 3). Moursund (1989) is even more expressive in his criticism: ". . .our colleges of education are doing a miserable job of preparing teachers to deal with the Information Age" (p. 9).

Needless to say, Perkins's and Moursund's standpoint in the issue of Information Technology and Teacher Education is one of the most detracting ones. However, there is a large body of literature that supports their point of view. In a report, Office of Technology Assessment (1995) predicted that American schools have 5.8 million computers in use for instruction. However, the number of teachers who report little or no use of computers for instruction is still considerable. In the same report, it is also demonstrated that teachers use technology for instruction in much more traditional ways rather than using computers as a tool to improve students' critical thinking and problem solving skills.

Despite the current attempts at preparing student teachers to use computer technologies, a large body of research indicates that "teachers are more hesitant and less likely to embrace computer technology than other professionals" (Paprzcki & Vidakovic, 1994: p. 74). According to Wetzel (1993) education majors who become teachers report that they hesitate to use technology and do not feel prepared to integrate technology into their instruction when they are employed in schools. This raises questions about the effectiveness of pre-service teachers' technology training.

Data Collection and Analysis

A questionnaire was prepared and distributed to those who volunteered to participate. In addition, semi-structured interviews were scheduled for participants to explore their feelings in depth about the effectiveness of the course. 20 (16 females, 4 males) students agreed to participate in the study. The questionnaire and interviews focused on the following areas:

1- *Expectations:* Students' expectations from the course, and effectiveness of the course in terms of satisfying their expectations.
2- *Attitudes and Computer Use:* Effectiveness of the course in terms of helping students develop positive attitudes toward computers.
3- *Other Factors:* Other factors that students believe contributed to the changes in their attitudes toward computers and increased their computer use.
4- *Professional Development:* Effectiveness of the course in terms of students' professional development.

In data analysis, qualitative methods were used. The original responses of the participants were put together and organized. Responses were coded under the areas listed above. Finally, conclusions were drawn in order to move from particulars to a more general class of conclusions.

Findings

Expectations:

The first question focused on the expectations of students from the course and the effectiveness of the course in terms of satisfying students' expectations.

Responses of participants clearly indicated that students had various expectations even though all expected to learn more about computers in education. For example, most of the students indicated the main reason for taking the class was to learn how to utilize the computer and software for teaching students in the classroom.

There were five participants who specifically outlined their expectations from the course. It was evident from their responses that they already had some previous computer experience. One of these students wrote that he had enrolled in every computer science class since 1991. Due to their previous exposure to computers, they were able to recapitulate their expectations. For instance, one of those stated that:

> I was expecting to learn how to make the most effective and efficient use of the available instructional technology in order to enhance the teacher-learner interaction. I also expected to learn the new classroom applications of the computers like WWW and Java language, so as to maintain my knowledge and skills up to date, given the fact that instructional technology is rapidly changing field. Finally as an educator, I would like to learn how to improve students' computer literacy in order for them to meet the demands of society and of the job market, which require an always higher computer literacy level.

When the same student was asked to evaluate the effectiveness of the course in terms of meeting his expectations, he stated that "This course did not satisfied my needs and expectations as much as I had hoped." He believed that he already had basic computer skills and he wanted to enhance his previous computer skills with new advance applications:

> This course did refresh my memory about certain software that I had previously been exposed to and this was fine. But, I was expecting to explore new applications and programming like JAVA and HTML and how to develop learning materials by using these programs. I guess this course was a great opportunity for those who had no prior knowledge of computers.

On the other side of the spectrum, the remaining students did not elaborate their expectations and basically indicated that they expected to learn how to utilize the computer in the classroom. Fulfilling the requirements for teaching credential was also a concern of one of the students. Unlike experienced students, one student stated that "I expected to develop increased confidence and enthusiasm about the computer. I thought this course was to teach us programming. I am happy that it was not." The following statement of a student is the best representative of how these students described their expectations from the course.

> When I enrolled in the course, I was expecting to be introduced to basic computer skills and software that I could use for myself and for the classroom. I also expected to learn more computer terminology so I may understand items using computer terms.

When the same students were asked to evaluate the effectiveness of the course in relation to meeting their needs, they all stated that the course was satisfactory and was of a high value to them. They thought that the course was useful to them not only as an educator, but also as a student because they learned how to access on-line sources for their class assignments. The following statement summarizes these students' perceptions of the effectiveness of the course in meeting their needs and expectations:

> The course was helpful because it introduced materials that I did not know before. The most useful parts were the spreadsheets and database because those were the two applications I felt most reluctant about using. The course has really supplied me with very valuable information. WWW search for lesson plans is one that I know I can use.

Students' responses to the first question clearly indicated that prior computer experience and knowledge shape their expectations. Students with previous experience enroll in computer literacy courses expecting that they would be able to enhance their current computer skills and explore advance computer applications and even programming languages. On the other hand, students with little or no prior computer knowledge expect computer literacy courses to introduce them the basic computer skills and applications. They also believe that the course should help them increase confidence about the computers.

Attitudes and Computer Use:

The second question was posed to determine how the course contributed to the changes in teachers' attitudes and computer use. Not surprisingly, all of the respondents reported that the course had positive effects on their attitudes even though some students reported much greater gains from the course than others. There were three students who stated that they had always had positive attitudes toward computers. Therefore, they believed that the information they learned from the course was supplemental. One of the students commented:

> Since I already had positive views about computers in education, this course merely supported those views. It did clarify some issues I did not understand. This course also opened up my eyes, a bit more, about the power of computers in education. Its effect on my attitudes towards computers has been positive because it has shown me how easier things can be using a computer.

On the other hand, the remaining students wrote that the course helped them to feel more positive and confident with computers. One student commented that,

> This course made me realize how important it is for the teachers to take a course like this and be exposed to computers because it plays a critical role in education today and or the future. I have also learned not only it is essential to understand the basics of computers, but it's also helpful in the classroom.

Another student reported that she was not comfortable with some of the new programs, but this course changed her fears to confidence in using them. Similarly, one student further elaborated on the reasons why he thought the course changed his attitude towards computers:

> This course changed my attitude toward educational uses of computers by teaching me how computers can make instruction more meaningful for K-12 students and how they can bring students to make connections across content areas. For instance, a hyper-media environment on a real life problem, such as building a bridge near the school, can bring pieces of the real world into the classroom and bring them under students' control. The course also changed my attitude toward computers by broadening my background on the possibilities they offer, and on the content available through software and the Internet.

When the students were asked to describe the affects of the course on their attitudes, they tended to express them in general terms. However, nearly all of them mentioned the following topics. They believed the course helped them develop positive attitudes by:

a. making them more at ease with using applications,
b. helping them gain more confidence,

c. increasing their awareness of computers and its applications, and
d. demonstrating how computers can be integrated into the curriculum.

In summary, responses to the second question revealed that all students believed the course itself contributed to the changes in their attitudes toward computers even though a few students manifested that this contribution was supplemental since they always had positive views for computers in education. It was very important to students that the course helped them gain more confidence and demonstrated them how computers could be integrated to the classroom teaching.

Other Factors:

The third question was asked to determine if there were other factors that students believe contributed to the changes in their attitudes and their computer use besides the course they completed. Responses to this question varied considerably. For example, one student reported that her home computer influenced her attitude, because she wanted to learn how to use it. She stated she wanted to get the most out of the class for what she paid. Another student believed it was the professor's willingness to teach them about computers.

Analyses of responses indicated that most respondents believed the demands they are facing from the schools at which they work is an important factor that helped them increase their willingness to learn about computers. For example, one student commented:

> Because I am a teacher, it is almost essential for me to be somewhat computer literate. The children in my class go to the computer lab often and so I have to be able to help them. This has made me want to learn more about using computers.

She further stated:

> The most important factor that has helped me feel comfortable with computers, however, is that I own one. The computer has proved to be extremely helpful for me when I am doing my schoolwork, my personal business and my work activities.

On the other hand, one student stated that it was not the computer utilization that encouraged her to learn about computers, but the lack of computer utilization that she had witnessed in the school at which she works. In addition, she commented, "I believe every child should be able to use them [computers] and it is our [teachers'] responsibility to teach them about computers."

There were three students who related their willingness to learn more about computers for more personal reasons. For example, one of them said, "I have two elementary school-age nephews, and I want them to learn computers to be successful in education as well as professionally." She further stated that her concern also extends to the students she is teaching. Another student thought that computers are beneficial for her own education and that makes her have positive feelings about computers. She wrote that, "the fact that computers have been an invaluable asset to me in my own education has greatly affected my attitude towards computers." Finally, the third student wrote, "I use a computer at work everyday, and it helps me handle my job more efficiently. I also extended my computer skills to communicate with my professors and co-workers and I love playing with the Internet."

In summary, it is clear that the most important factor for teachers that they believe affected their computer attitudes besides the course was seeing their students already using them in the class. They felt that as a teacher they also have to be computer literate and help their students with their endeavours. Analyses of the responses to the third sub-question also indicated that the possession of a home computer increases teachers' access to computers and as well as their willingness to learn more about them. Finally, given the fact that pre-service teachers are also students working on their teaching credential, they felt computers were providing a great asset to them in their own education and thus, it helped them develop positive attitudes toward computers.

Professional Development:

The last question sought to discover whether student teachers believed the course contributed to their professional development. There is a sizeable body of research suggesting that students value a course more if they believe the course contributes to their professional development. Research also indicates that when students value the course they are more likely to have positive attitudes toward it. That is why the question for the last theme was asked to participants to find out if they valued the computer literacy course in regard to their professional development.

Analyses of responses to the question indicated that students valued the course according to their previous computer experience. Those who had prior computer experience reported that the course did not

contribute a great deal to their professional development, while non-experienced students thought that the course definitely contributed significantly to their professional development.

On one side of the spectrum, experienced students indicated that the course could have contributed to their professional development if the content was determined in an accord to their needs. For example, one student commented:

> I would recommend this course to those who are not at all familiar with computers. However, for experienced users, I didn't find it challenging enough. It was a lot of busy work as far as the homework was concerned. This course did add computer terminology that I was not very familiar with, but most items were not new to me. Also, I did obtain a few practical ideas about using computers in the classroom, but again, I would have wanted more.

Another experienced student agreed with the previous student's feelings about the course. He further suggested:

> I would rate the course above average because I felt it took a bit long on the basics like the hardware and monitor. A more effective way would be to divide the class into those with no experience/those with some/and expert. Once we got into working on different programs this course did help my professional development.

One student underlined the importance of a follow-up course for teachers' professional development. She wrote that, "it needs to be more in depth. This course breezed over a lot of information because of the time frame, but for our professional development, a follow-up course is needed so teachers are more competent with computers."

On the other side of the spectrum, students with no or little prior experience with computers indicated that the course was of a great contribution to their professional development. One of these students wrote:

> This course has been one of the most valuable classes I have taken. It has opened many new avenues for me to explore. Now that I have gained a better understanding of the programs available to me, I can better teach my students and prepare them for the 21st century. Each child must become computer literate in order to succeed in our highly competitive world. As their teacher, I am responsible for their success.

Another student also thought that the course definitely contributed to her professional development. Similar to experienced students, she further indicated that she was in favor of having more computer courses. She commented that, "I did value this course and wished there were more courses just like it or similar offered because I would surely enroll and enjoy them very much. This course helped me to feel more advanced/educated in my field." Another student gave a concrete example in order to describe the effects of the course on her professional development while she believed that the course was only a beginning for her. She wrote:

> I am satisfied this course has contributed much to my professional development. Surely, I still need to learn much more knowledge and skills to consider myself truly computer literate. yet this course has sent me on the road toward becoming computer literate. I am definitely a lot better than when I first began.

It was obvious from the responses that the more new skills students gained from the class, the more they valued the class and the more the class contributed to their professional development. Interestingly, regardless of their previous experience with computers, the students believed that a follow-up computer course would significantly contribute to their professional development. Finally, all respondents agreed that the course was very useful to those who had no prior computer experience.

Conclusions and Recommendations

Based on the findings, the following recommendations are offered for practitioners and teacher education institutions:

1. Unquestionably, the best way to encourage teachers to use computers in the classroom is to increase their level of competency. This can best be achieved by providing several computer literacy courses that are designed according to the individual's level of confidence, anxiety, and competency.

2. If more advanced computer literacy courses are not available for those who are highly competent users and request specific training on high-end software, those individuals should be assigned to more challenging assignments based on their competency levels and expectations. On the other hand, teachers with no or little prior experience should be provided with more personal attention to explore the basics of computers.
3. Even though every student teacher is mandated to take at least one educational computing course, the value of this course is limited unless computers are integrated into the entire teacher education curriculum. Therefore, teacher education institutions should take the initiative to employ new policies to incorporate technology into their curricula outside of computer literacy or instructional technology courses.
4. Faculty of teacher education programs should demonstrate their competency and willingness to use technology in teaching. They should be role models for prospective teachers in integrating technology into the classroom teaching.
5. Teacher education programs should provide technology training for prospective teachers which can satisfy their specific needs in the schools at which they work. Therefore, teacher education institutions and schools districts should cooperate in designing technology-training curricula to meet teachers' specific technology needs.

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EDUCATIONAL LEADERSHIP

Courses on Issues in Instructional Technology for Educational Leadership

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The University of Texas at Austin and Texas A&M University have been collaborating to create courses for administrators which would offer both knowledge about and experience with technology. The intent is to provide well-designed courses and on-going support and training directed at administrators on the infusion of the latest technologies, particularly telecommunications technologies and the management of telecommunications. The courses are needed to move technology to higher levels of use in our schools by providing these administrators with the knowledge base they need to make important decisions. Our presentation will cover the issues considered and the practical steps taken in the planning and implementation of these new courses for both preservice administrators and those working in the field.

The Selection of an Instructional Management System

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Abstract: As more states develop specific learning standards and benchmarks for students, school districts are faced with the challenge of aligning their curriculum with these standards. Many attempts have been made to develop a seamless approach to integrating standards and curriculum. One of the methods now moving to the fore is the use of computer based Instructional Management Systems (IMS) to help accomplish this goal. In addition this curriculum/ standards alignment, IMS systems also provide the ability to track individual student performance and outcomes as they relate directly to the curriculum being taught. This paper describes one such attempt to align standards and curriculum and track student performance undertaken by the School district of Palm Beach County Florida. The paper discusses the steps taken to select acceptable computer management systems, the evaluation of the various systems considered, and the final selection of an IMS.

Introduction

In 1989 the country's governors and then president George Bush met to discuss ways to improve student performance in the United States. The report that resulted from that conference became know as America2000. Since that time many states have steadily worked toward the establishment of educational standards and benchmarks. Initially, standards for mathematics and science were developed by organizations such as the National Council of Teachers of Mathematics and the National Science Foundation and either adopted or recommended by the states to their area school districts. However, over the past nine years the formal adoption of state educational standards in almost all the major curriculum areas has grown steadily. A recent report prepared by the Council of Chief State School Officers (CCSSO) (1998) summarized this steady growth. Currently, seventeen (17) states have adopted educational standards. An additional twenty-six (26) states report that state standards are currently under development, while only eight (8) states have not begun the process of adopting standards. It is also interesting to note that more than twenty (20) states report the implementation of some form of standardized assessment and another twenty-one (21) states say that an assessment is under development.

The information reported by the CCSSO demonstrates the importance that states are placing on educational standards. What is not reported however, is the crucial task of aligning goals, standards, benchmarks, and assessment with curriculum. Curriculum alignment must occur if the use of standards and "high stakes" testing is to bring about improved student performance. "Curriculum is a living document, growing and changing. It is a blueprint to engage students in learning. Curriculum is the foundation of school." (Hunter, 1997).

A major challenge associated with these emerging curricula and standards is the alignment of the two into a seamless approach to education that benefits the students. Many attempts have been made to accomplish this task. One of the methods now moving to the fore is the use of computer based Instructional Management Systems to help accomplish this goal. "Information management is vital to the alignment of curriculum objectives, outcomes and standards with instruction and assessment and to demonstrate the delivery of both the curriculum and instruction as intended." (Carter, 1997). Coupled with the alignment should be the ability to track individual student performance and outcomes as they relate directly to the curriculum being taught. One such attempt to align standards and curriculum and track student performance has been undertaken by the School District of Palm Beach County Florida.

Like many school districts, Palm Beach County was seeking ways to improve student performance, help teachers develop better lesson plans, and create more meaningful classroom assessments. One of the major undertakings of the District was the selection of an Instructional Management System (IMS). This paper will outline the selection process used by the District and will provide some basic information which other Districts or schools may find useful in their own search for an IMS.

Background

Like all Florida's school districts, Palm Beach was required by the State to align its curriculum with recently adopted Florida Sunshine State Standards (SSS). The school district staff, led by the Office of School Improvement, decided to investigate the use of a technology based Instructional Management System (IMS). In an effort to bring about significant school improvement, the use of technology in "...the acquisition and use of information for data-based decision making, Information Management Systems (IMS's) are of fundamental importance..." (Carter, 1997). Carter goes on to state that "It is necessary to put the curriculum "on-line" in order to address adequately the close monitoring and reporting of student progress and performance against outcomes." The District's goal was to select a system "...designed to align the Sunshine State Standards, curriculum, instruction, and assessment to address individual needs of the students and track their progress achieving the Sunshine State Standards." (Cartlidge, 1998). Three schools were selected to participate in the selection process and become the "pilot" schools or testing sites for the selected IMS. All three schools are located in the western area of the school district and, based on students standardized test scores, are on the state's list of lower performing schools.

In order to accomplish the review and selection process, the District staff assembled a Design Team to develop evaluation criteria, review, evaluate, and make a final recommendation on an IMS to the District School Board. The Design Team consisted of school and district level staff, teachers, and two outside (non-district employees) consultants. The consultants are the authors of this paper.

The Goals 2000 Grant set out a "...sequence of events that lead to the selection of an IMS and the development of its implementation plan..." (Cartlidge, 1998). The selection process schedule was ambitious, as shown in the following summary:

August 1997	Design Team Formed
September 1997	Research software companies providing IMS Determine evaluation criteria
November-March 1998	Proposals and presentations from IMS providers
February-April 1998	Site visits to schools utilizing IMS of prospective vendors
April 1998	Recommend IMS
May 1998	Obtain District Board Approval

The Process

It was the responsibility of the Design Team to "…select a computer management system to track student progress on the Sunshine State Standards and the Palm Beach Curriculum Guidelines" (Cafolla,1998). To accomplish this task, the Design Team secured proposals from qualified providers of IMS systems, reviewed the proposals, narrowed the list of prospective providers, participated in presentations and demonstrations of IMS products, analyzed information, and finally, recommended an IMS to the School Board. In order to accomplish these goals, several objectives were established. These objectives included:

1. Develop evaluation criteria.
2. Review software packages and vendor qualifications.
3. Evaluate the Instructional Management Systems.
4. Make recommendations on the selection of an IMS to the District Staff and the Palm Beach School Board.

Consequently, the establishment and composition of the Design Team was of the utmost importance. It was considered essential to insure representation on the Team from all areas of the educational staff: School Improvement staff, lead teachers, Instructional Technology staff, Data Management System staff, and Professional Development Staff. In an effort to insure a broad cross-section of the educational community, the District added consultants from Florida Atlantic University (FAU) and the Area Center for Educational Enhancement (ACEE) to round out the Design Team. The FAU representative was an associate professor in the Department of Technology and Research of the College of Education. The member from the ACEE had a teacher training and technology background and was concurrently working on a Master's degree in Educational Technology.

A list of prospective vendors was developed with the help of the Mid-continent Research and Educational Laboratory (McRel). An initial contact was made with the companies from the list. Once it was verified that a company was capable of providing an IMS, a letter of interest was sent outlining the goals of the project and requesting information on the IMS the vendor represented. Using this method of contact and verification, the Design Team asked for and received responses from four vendors. As the information from each vendor was received, it was routed to the Design Team for initial review and evaluation. Following the initial review and verification that the vendor could supply an IMS, an invitation was extended to each company to develop a presentation and proposal specific to the needs of the Palm Beach School District.

Criteria

The evaluation process had to be accurate and fair. In order to accomplish this, the Design Team developed an evaluation criteria. The Team agreed that at a minimum any system that qualified had to be able to track student performance on the Sunshine State Standards and the Palm Beach County Curriculum Guidelines. With this main criterion established, additional criteria relating to systems hardware and software were developed. These added criteria included:

- Flexibility, Expandability
- User Friendly
- Experience and Qualifications of the company
- Experience and Qualifications of representatives assigned to the District account
- On-going management and support
- Capability of District maintained system after implementation
- Cost benefit analysis
- Hardware needs
- Data Management
- Network Capability
- Operating Environment

- Data/Information access and security
- Reporting capability
- Graphics
- Maintenance and Support after implementation
- Training and training updates
- Documentation
- Cost

The evaluation criteria also included more subjective measures. The Design Team felt strongly that the software had to be "user-friendly." It stands to reason that if the software is not easy to use, teachers will not incorporate it into their day to day instructional decisions and the potential benefits of the system, however substantial, would be lost. To assess the usability of the software, each vendor was asked to allow the District to utilize the software for two or three months prior to purchase as a field test. The Design Team was well aware that the decisions to be made were going to be far reaching. The selected IMS would become part of the school improvement efforts of the District at the three selected pilot schools. It was also understood that the desire of the District was to consider expanding the use of the IMS to other schools within the District over the next 2-3 years as part of a District-wide school improvement effort.

Finally, each vendor was required to provide a working demonstration of the software system they had developed. This point is a key in any search for an IMS. The need for an IMS was based on existing problems and proposed solutions. It was essential, therefore, that the IMS be an actual working system and not a system promised for release "Real Soon, Now." We found many vendors were promising the components in "the next version."

Evaluation

Once the evaluation criteria was developed and agreed upon, the process of reviewing the proposals from prospective vendors began. Each proposal had to be reviewed with the same dispassionate eye using the criteria previously outlined. It became apparent at the initial meeting that those on the Design Team having a less technical background were dependent upon the others for guidance. This type of problem is not unique to selection committees but must be addressed from the very beginning. It must be made clear to all Design Team members that their input is valuable no matter what their particular area of expertise. Rarely does one individual have all the knowledge necessary to make this type of decision. The technical knowledge is of obvious importance, but one should not fail to recognize the valuable input of the classroom teachers and school administrators. These are the people that will be using the IMS and must be as comfortable with the system as the technology staff that will maintain it. Without the support of the end-user (the teachers in this case), even the most sophisticated system will not be utilized. To insure this end-user input the lead members of the Design Team (District Office of School Improvement Staff) engaged each member of the team in the review process.

Members were asked to review each proposal as it was received. They were then instructed to complete the evaluation on the forms provided prior to attending the meetings. It was hoped that independent reviews based on different needs and expertise would result in a more successful process and a truly unbiased review of each vendor's system and capabilities. In this way, the influence of other committee members was kept to a minimum and each IMS proposal was given a complete and fair review.

The ideal review process would have all the proposals and demonstrations occur within a very short time frame. Doing so keeps the process on track and allows members of the Design Team to catalogue the advantages and/or disadvantages of each software package. Unfortunately time restraints, commitments of team members, and vendor schedules prevented the reviews and presentations from being scheduled on consecutive days. However, every effort was (and should) be made to conduct the process in a timely manner, with reviews and demonstrations scheduled as tightly as possible.

The final step in the evaluation process consisted of on-site visits to schools that were actually using the IMS. These visits served several purposes. First, the opportunity to view the software in a working environment was very important. Teachers and administrators were given the chance to see and use the different IMS packages in school settings. This also provided the Design Team members contact with more experienced users who could provide input into the more subjective criteria such as ease of use.

Second, the site visits enabled the Design Team members to draw their own conclusions about the usefulness of the IMS. In one case system was rated highly by the committee following review of proposals and demonstrations. However, the on-site visits and discussions with existing users painted a very different picture of the IMS. Problems with usefulness, the interface, and the ability for teachers to utilize many of the "features" presented in the proposal were evident. Teachers using the software, while enthusiastic about the possibilities, were somewhat disappointed in its actual performance. In another instance, the software package was not up to the challenges presented by the District.

Third, interaction with technical staff at the various schools and districts proved enlightening. Problems were highlighted, features (both good and bad) and important information about operating system environments, system requirements, disk space, and network considerations were discussed. This step in the evaluation process should not be dismissed lightly. In fact, it was information obtained during the on-site visits and user conferences that helped finalize the District's decision.

Conclusion

When all the evaluations, reviews, demonstrations, and on-site visits were completed, the DesignTeam met to make its final recommendations and selected CampusAmerica's IMSeries system (CampusAmerica, 1996). The IMSeries software met all the requirements and in demonstrations and hands-on trials was the unanimous selection of the Team. It is interesting to note that this system was the unanimous choice of the Design Team. This was surprising given the diversity of the professionals represented. In point of fact, CampusAmerica's IMSeries was clearly superior to the other systems evaluated.

All school districts today face the ever-increasing challenge of preparing students for the future. Increased emphasis on "high stakes" testing, benchmarks, and performance standards have school board members, district staff, school administrators and teachers all seeking ways to improve student performance, develop better lesson plans, and create more meaningful classroom assessments. The selection and use of an IMS can help ease these pressures. The process outlined can be a blueprint for schools and school districts to begin the process of selecting and using an IMS.

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The Development of a State-Wide Technology Performance Assessment

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Abstract:
A direct approach to assessing teachers' basic computer skills and knowledge is to ask them to create some specific computer-based products. This performance approach was taken by the developers of the Idaho Technology Performance Assessment at Lewis-Clark State College and the University of Idaho. Between its beginnings in July 1997, and its approval by the Idaho State Board of Education in September 1998, this assessment tool was designed, piloted, and revised by a team of college and K-12 educators. The developmental process and features of the performance assessment are described.

Background

In November 1997, the Idaho State Board of Education passed a policy requiring all Idaho School Districts to provide evidence by June 2001 that 90% of their teachers and administrators have mastered basic technology skills. The policy requires that mastery be measured by an assessment consistent with the *ISTE Recommended Foundations in Technology for All Teachers* developed by the International Society for Technology in Education (1998).

As the state was finalizing its policy, two professors at neighboring colleges in north central Idaho recognized the value of providing teachers with a performance assessment option. Scott Coleman at Lewis-Clark State College, in consultation with John Davis at the University of Idaho, began creating a technology performance assessment that would measure basic computer technology competence, as defined by the ISTE standards. With the clear recognition that such an approach could support and complement existing efforts help K-12 teachers learn to use technology in the classroom, this project was begun.

Brief Description of the Assessment Instrument

As with any performance assessment, this assessment consists of *authentic* tasks whose successful completion indicate mastery of specific knowledge and skills. The Idaho Technology Performance Assessment (ITPA) is made up of six discrete tasks. This set of tasks is designed to assess mastery of basic technology competence as defined by the ISTE technology standards for K-12 teachers. Each task requires teachers to create a product. In task 1 a critique of a piece of educational software is written. In task 2 a teachers write a lesson plan in which students use computers. In task 3 teachers use a spreadsheet to analyze student data. In task 4 teachers create an electronic poster. In task 5 an electronic presentation is created. In task 6 teachers write a review of a web site.

Development of the Performance Tasks

Between July and September 1997, the assessment development team wrote and refined the six assessment tasks. The six-task structure originated from a technology self-assessment instrument that had been previously developed. Each task was designed to assess both computer-based skills and conceptual understanding related to effective and ethical use of technology in the K-12 classroom. The most interesting design challenge was to blend the integrative elements of the ISTE standards with the six categories of skills to produce realistic tasks. Looking at the assessment subtasks, listed in Table 1, you can see the blending of skill and integrative components.

Idaho Technology Performance Assessment Tasks and Subtasks

Task 1. Basic Computer Operations: Reviewing Educational Software
1. Can describe in writing how to install and open software.
2. Can describe in writing the software's features
3. Can do basic file management: open a document, save a document, print a document
4. Can describe how to use software with students

Task 2. Word Processing: Formatting a Lesson Plan
1. Can do basics of text entry and manipulation: opening application, typing, editing
2. Can do text formatting: fonts, font size, bold
3. Can do document formatting and management: margins, spell checking, saving, printing
4. Can design a lesson where students use computers

Task 3. Spreadsheet/Database: Organizing and Analyzing Student Information
1. Can do basics of data entry and manipulation
2. Can format
3. Can do calculations
4. Can make ethically sound decisions about using technology in the classroom

Task 4. Digital Imaging: Using Graphics to Create an Electronic Poster
1. Can acquire graphics from peripheral devices (digital camera, scanner)
2. Can move graphics from a peripheral device into a graphics application
3. Can adjust the size and placement of graphics and text in a document
4. Can describe how a teacher can organize the learning environment for effective computer use by students

Task 5. Electronic Presentations: Presenting Information about Teaching with Technology
1. Can create text in an electronic presentation
2. Can create graphics (lines, clip art, etc.) in a presentation
3. Can run an electronic presentation
4. Can describe how to support accommodating all students, encouraging life long learning, assessment, and ethical use with regard to using computers with students

Task 6. Using the Web and e-mail : A Web Site Review
1. Can open a browser and use a search engine
2. Can move text from the WWW to a word processing document
3. Can write and send an e-mail document
4. Can evaluate the effectiveness of a website for educational purposes

Table 1: Idaho Technology Performance Assessment Tasks and Subtasks

In February 1998, three teachers participated in a *pre-piloting* of the performance assessment instrument. The three members of this group were experienced computer users, representing a wide range of grade levels. The group provided feedback regarding the time requirements, difficulty level, clarity of instructions, and face validity of the first draft of the performance assessment. Following this, the development team revised the instrument, in preparation for a major piloting effort over the next two months.

Between March 27, 1998 and May 7, 1998, 62 teachers and technology coordinators participated in a large-scale piloting of the performance assessment. Approximately half the pilot group took the performance assessment at Lewis-Clark State College (LCSC). The other half of the pilot group took the assessment at one of several K-12 school sites. During summer, 1998, a second large-scale piloting occurred. Eighty teachers took one or more parts of the performance assessment at LCSC; another 20 teachers took the assessment at one of two K-12 schools.

Throughout the development/pilot phase the performance tasks instructions were fine-tuned to make them as clear and unambiguous as possible. Many of those involved in the pilot were interviewed immediately after completing the assessment for feedback. Careful attention was also paid to informal comments. Numerous revisions were made for the purpose of ensuring that the task instructions could be followed by those taking the assessment without the need for additional verbal or written instructions.

Development of the Monitor Role

A central feature of the ITPA is that it allows those being assessed to take the assessment at their own school, using familiar hardware and software. To make this possible, local *monitors* are trained to make the assessment available at local school sites. Monitors are teachers or technology specialists. The monitor is a non-judgmental observer, whose main function is to ensure that the assessment is completed without assistance.

As the monitor role developed, it became apparent that the monitor's duties needed to be very specifically defined. The specific delineation of the monitor's role was done using a document called the *monitor checklist*: a list of the items that the monitor checks during the assessment. The monitor checklist was fine-tuned during the developmental phase, with ambiguity being discovered and remedied under actual use.

Other duties, beyond that of completing the monitor checklist, were defined and refined during the pilot phase. The essential elements of the overall monitor role are apparent in Table 2.

Monitor Responsibilities

Performance assessment monitors make the Idaho Technology Performance Assessment available to teachers in their local area, allowing the assessment to be taken on familiar equipment, using familiar software. The monitor's main responsibility is to ensure that the performance tasks have been completed without assistance by the person whose work is submitted to the scoring team at Lewis-Clark State College.

Before monitoring at a school building, a monitor must have the principal at that building sign the form Arrangements with the School Principal and will return a copy of the form to Lewis-Clark State College.

The monitor must keep the assessment packets, which include the task instructions, monitor checklists, disk(s), and all products printed during the assessment, in a secure location.

It is the monitor's responsibility to request packets from LCSC at least two weeks before they are needed.

The monitor must make preparations for performance assessment, including arranging the time and location and ensuring that the necessary computers, peripherals and software are available.

The monitor must observe all people taking the assessment closely enough to be able to answer all questions on the monitor checklist.

The monitor must note, on the monitor checklist, any questions that are asked during the assessment, and their answers (except for procedural questions) as well as to note any technical problems that occur and the way they were resolved.

The monitor must return completed packets to LCSC at the earliest possible date after completion and to be sure that a check is enclosed or that arrangements have been made to have the district directly pay for the assessment.

Table 2: Idaho Technology Performance Assessment Monitor Responsibilities

Scoring Aspects

The ITPA scoring system takes into account that the state requires an indication of mastery or non-mastery -- not a specific level of mastery . For this reason, the assessment scoring system was designed to yield simply a pass or fail score for each of the six assessment tasks. The scoring system also takes into that all six tasks measure essential competencies: therefore all six portions must be passed to earn an overall passing score.

A scoring rubric was designed to allow scorers to assign a score to each of the 24 subtasks (4 subtasks x 6 -- see Table 1 for a description of the subtasks). Each of the four subtasks in a task is worth up to 4 points for a maximum of 16 points per task. Earning 12 or more of the 16 possible points is required to pass a task.

A "3" is conceptually defined in the rubric as *minimal competence* for that subtask. As the developmental phase progressed and the scoring rubric was revised, the specific meaning of "3" for each subtask became more clearly defined.

It became very clear during the developmental phase that any ambiguity or inconsistency between the scoring rubric, the instructions, the monitor checklist, and the preparation handout had to be eliminated. The procedure of revising all four of these documents together and releasing updates for all at the same time was implemented.

Administration Issues: Packets and Databases

Over the developmental period two critical administrative issues became very obvious: 1) the large amount of information and paper that needed to be organized *before* the assessment; 2) the large amount of information and paper that needed to be organized *after* the assessment.

To organize the many sheets of paper that had to be printed, sorted, and kept together, the development team decided to keep all the instructions and monitor checklists in a manila envelope. The envelope and its contents became known as a *packet*. To help track what was inside the packet envelope, a label was attached to the outside of the packet with spaces for names and dates.

To cope with the data acquired before, during and after each assessment is taken, a database was created using *Filemaker Pro*. The database tracks names, scores, e-mail addresses, schools, dates, etc. and simplifies data entry by allowing people to register themselves directly into the database using the web.

Validity and Reliability

Approval of the performance assessment by the state required that a convincing case for validity and reliability be made.

The case for validity was built by clearly defining what the validity means in this context, showing that the assessment does measure the ISTE standards, and correlating observed (over an extended period of time) competence with competence measured using the assessment instrument.

Validity was defined as the degree to which those who pass the assignment actually have basic competency and the degree to which those who fail the assessment actually do not. This definition makes it clear that the meaning of technology competence has to be established. This was done by showing that each of the ISTE standards was measured in one or more subtasks (see Table 1 for a list of the subtasks).

A small study was done in which *actual* technology competence, determined by long term observation of teachers' use of technology in their classroom, was shown to very closely correlate with the performance assessment results. Those teachers who scored highly on the assessment were those who were successfully integrating technology in their classrooms.

The primary reliability issue during the pilot was to establish that results could be given with a high degree of consistency. For this to be the case, the scoring procedures, rubric and scorer training would have to be adequate to ensure that same result (pass or fail) would be given repeatedly to a specific performance. Supporting the case for consistency is the policy that calls for a team of three scorers to share responsibility for assigning a task score. Any task that is near the pass/fail point is scored independently by at least two, and up to three scorers. An additional support for consistency was a study done to check the consistency of independent scorings. Using a sample of pilot assessment results, independent scorers showed very high correspondence of scorings at the subtask level and a nearly perfect correspondence at the task level.

Lessons Learned

Two months after its approval, the ITPA is being used in 11 Idaho School Districts, and will soon be available throughout the state. Response from teachers and administrators has been very positive. Although it is too soon to claim that the assessment is a worthy of wider emulation, there are several lessons that were learned during development that may be of use to others.

Belief in idea behind this performance assessment, understanding its value in providing a convincing yet efficient way for teachers to be able to demonstrate competence in a familiar setting, was essential to keeping the development moving forward -- providing both guidance and inspiration. Having a clear sense of direction and purpose was invaluable.

The development team consisted of a group of people with a variety of specialized abilities. This was essential given a project requiring high levels of instructional design, administrative, organizational and technical skill. The variety of skills alone however was not enough – the development team was also fortunate in being able to meet face-to-face on an almost daily basis and to enjoy working together. This diverse, yet cohesive team made it possible to solve every essential problem during the development of the performance assessment.

The amount of revision needed to perfect the assessment documents and policies seemed to be never ending. Early versions that seemed quite adequate were shown to need revisions when used with larger numbers of people in another setting. Awareness that it takes much time to discover and correct minor flaws is essential.

Two decisions by the Idaho State Board made the development of the ITPA easier. First, by defining technology competence using the ISTE Foundational Standards and requiring that those standards be the basis of validity it was not necessary to independently define technology competence. Second, by establishing a policy that required the assessment to yield only a pass or fail score, a relatively simple yet highly reliable scoring rubric was possible.

Finally, it became apparent to the development team that a *high stakes* assessment such as this one is very likely to cause significant anxiety, despite attempts to minimize or eliminate it. Recognizing this, and responding with consistent efforts to communicate clearly and encourage calmness, is essential.

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Idaho Administrative Technology Leadership Center

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Abstract: Studies show that school administrators' training and knowledge base have not kept pace with technology, causing a lack of administrative support for the integration of technology beyond a basic level. The project established a transportable technology training laboratory for present and future administrative leaders in Idaho's public schools. The transportable lap-top computer lab with peripheral equipment and Internet capability is transported to individual school sites where it is used by trained university faculty to offer appropriate technology preparation to school district administrative personnel. The program addresses a pervasive need within the field of education and brings Idaho and its universities to the fore in finding solutions to the problem.

The Problem

Current research indicates that schools with effective technology curricula also have strong administrative leadership supporting and sustaining effective technology programs for both teachers and students (OTA, 1995; Richie, 1996; Richie & Rodriquez, 1997). It is most important to observe what the research implies about the weaknesses of technology programs at the building and district level: A strong apparent variable in weak programs points to the lack of knowledgeable and supportive principals and superintendents in respective school districts.

To date, the Idaho universities training future school administrators (Idaho State University and University of Idaho) require no *administrative-based* technology training or coursework in their educational administration preparation programs. Although most states require school administrators to take courses in leadership, management, and the challenges of special education, few require administrators to be technologically competent (Richie & Rodriquez, 1997).

The Idaho Administrative Technology Leadership Center addresses this critical issue and specifically targets the educational leadership program at Idaho State University (ISU) and the training of practicing administrators in 55 school districts in eastern Idaho. ISU faculty travel to Moscow/Boise to prepare University of Idaho (U of I) educational administration faculty who will prepare school administrators in an additional 57 school districts in western Idaho.

Both aspiring and practicing school administrators receive specific on-going training in Schools Administrative Student Information (SASI), Instructional Management of Curriculum Development (Abacus and Curriculum Designer), and Data Driven Decision Making (Statistical Package for the Social Sciences). The professional development also focuses on the management of human resources, payroll, transportation and food services, school law and finance, and the management of information useful in making decisions about instruction, assessment, and curriculum.

Collaboration

The collaboration between colleges of education and public schools has been strengthened and expanded so the training offered in educational administration preparation programs is closely related to the needs of administrators in the field. The project brings together the ISU educational administration faculty with 55 school superintendents, and approximately 258 school building principals. Collaboration also exists with the Office of Professional development for Schools (OPDS), the Region 4 Magic Valley Partnership, the Region 5 League of Schools, and the Region 6 School Partnership.

With the use of the transportable instructional lab, ISU faculty will provide administrative-based technology training for the U of I educational administration program area instructors. Once prepared, the

U of I faculty will provide professional development to school administrators in Regions 1, 2, and 3 in the western half of the state. The breadth of this collaborative training creates the potential for (a) preparing all faculty from the two major university preparation programs, (b) providing administrative-based technology training to every public school administrator in Idaho, and (c) building a foundation for data-driven decision making for K-12 education.

The Office of Professional Development for Schools meets monthly with superintendents in each of the three regions to set priorities, and plan services and staff development for individual school districts. Administrators have identified administrative-based technology and training in data-driven decision making as priorities in their schools. The need also exists for services specific to their individual school and staff (i.e., small rural vs larger urban districts). The transportable training lab includes programming custom-tailored to the needs of individual schools and staff members.

The ISU faculty are collaborating with the Idaho Association of School Administrators (IASA), a statewide professional development organization with a membership of over 750 administrators. The transportable training lab expands and compliments the IASA's delivery of its Idaho Administrator Technology Academy Program to administrators in eastern Idaho. The focus of IASA's Academy is basic technology training such as word processing, spread sheets, and data bases: the transportable lab focuses on student information systems, and emphasizes the collection and interpretation of school-site data used in making decisions affecting teaching and learning.

The Instructional Technology Resource Center (ITRC) assists the ISU educational administration program area in giving faculty the access, ability, and confidence to utilize multimedia tools and new technologies in the traditional classroom and the World Wide Web. Three ITRC technical consultants provide daily assistance to educational administration faculty with the integration of WebCT and their administration preparation courses. Currently, several courses offer on-line instruction to graduate students in Idaho Falls, Soda Springs, and Twin Falls, via WebCT, a sophisticated World Wide Web-based educational environment facilitating learning, collaboration, and communication. WebCT is also used to offer supplemental administrative-based technology training to our 55 school districts in eastern Idaho.

Faculty Development and Productivity

National Computer Systems (NCS), a computer software company specializing in the distribution of administrative-based software offers on-going staff development to all ISU educational administration faculty in the use of the specific software used by school districts in eastern Idaho. NCS has supplied, at no charge, state of the art dual platform (Mac and PC) software on individual faculty computers and the transportable instructional lab, to be used for administrative preparation at the masters and doctoral level. The dual platform software includes: (a) SASI – a school information system of attendance accounting, master scheduling, student assessment, college entrance requirements, and course scheduling; (b) ABACUS – an instructional management system focusing on curriculum development and alignment to state and national standards and frameworks; (c) MENTOR – an instructional and assessment tool for teachers designed for the grading and evaluation of student writing; and (d) CIMS – an information system covering human services, payroll, transportation/food services, finance, and school law.

Institutions of higher education may offer the greatest resource for improving the success and appropriate use of technology in our schools. A component of the Idaho Administrator Technology Leadership Center involves substantial training for all educational administration faculty in the area of developing technology skills. Equally important is the focus on conceptual knowledge of how technologies can be used to augment student learning. The training also emphasizes the leadership and strategy skills needed to promote, achieve, and sustain a vision of how schools can and should evolve in a society that will increasingly depend on creative, technology-using citizens.

Alternative Methods of Instruction

The predominance of traditional instructional modes should be a concern to those who seek improvement of preparation programs (Murphy, 1997). This traditionalism in instruction is particularly problematic in a field that purports to emphasize educational leadership. Much of the state's educational

administration instruction is classroom bound: Administration is talked about rather than observed, felt, and in these and other ways, actually experienced (Hallinger & Murphy, 1991). An on-going problem with offering appropriate preparation to our school district administrators is one of geography. In addition to the problem of distance, it is rare indeed for administrative trainees to take time away from their full-time jobs to attend classes at the university.

More than ever, it is necessary for universities to *reach out* and offer courses and staff development in the field. More and more school administrators are benefiting from instruction closer to their work site. The transportable training lab allows for instruction to be customized to specific needs and also helps create a more seamless environment between theory and practice. This method of instructional delivery addresses the *cry* from practitioners in the field who argue that university preparation programs do not reflect the reality of the workplace.

Administrators learn skills on site, in context, and integrated with real-life applications. Activities begin with administrative duties such as budgets, memoranda, and strategic plans, and advance to technology-related activities emphasizing the collection and interpretation of school-site data used to make decisions which affect student learning.

Increased Access to Educational Programs

With the access of a transportable lap-top computer lab, educational administration faculty use technology to deliver instruction at four ISU sites: (a) Pocatello, (b) Idaho Falls, (c) Twin Falls, and (d) Soda Springs. An additional advantage of the portable environment is the potential for several faculty to use parts of the lab at different sites at the same time.

An Idaho Falls master's degree cohort of 33 students began in the 1998 spring semester, with the similar sized cohorts in Twin Falls in the summer of 1998, and in Soda Springs in the fall of 1998. Beginning in the spring of 1999, a 22 member cohort enters the doctoral program in educational leadership. Currently these sites do not have adequate facilities, equipment, or appropriate software to provide instruction in Leadership in Instructional Technology. The transportable computer lab impacts approximately 30 students at each of the four sites per semester.

Though the thrust of ISU Technology Leadership Center is administrator preparation, the potential for increased professional development for classroom teachers has become a natural extension. Teacher education students will learn to use administrative tools to enhance tasks such as grade reporting, attendance, discipline, and analysis of student success.

Measurable Impact on Learning

A goal is to create learning environments and activities that are learner-centered and learner-controlled, designed on the principle that accomplishment and success are the result of teamwork and group efforts. Ten performance standards are set throughout the semester that identify student success and performance. For example, graduate students and administrators are expected to construct a school master schedule using the School Administrative Student Information (SASI) software package. An additional performance measurement is the ability to access specific K-12 student information to solve complex problems such as identifying causes of limited minority student enrollment in advanced math classes. The program is based upon the use and evaluation of school data to drive and judge instructional success and progress. The Office of Technology Assessment has found that administrators who are informed, comfortable, and competent with technology become key players in leading and supporting technology in schools (OTA, 1988; 1989; 1995).

The measurable performance outcomes accompanying the project objectives are: (a) provide cutting-edge preparation in school-based software applications to 100% of the ISU students training to be school administrators during the life of the program and beyond, (b) customize this same training to reach 258 (90%) of the school district administrators in southeastern Idaho, and provide that training at various sites around the regions, including ISU branch campuses and individual school sites, (c) assist current administrators in implementing the strategies/techniques learned in the training; these will be measured by

a survey gauging user-satisfaction, and (d) expand the program to include U of I faculty and students, plus the 57 school districts it serves with professional development needs.

The outcomes of the program will be measured quantitatively by comparing actual outcomes to the projections above. Outcomes will also be measured qualitatively, using feedback from staff involved in the project, user-satisfaction surveys, and the findings of an independent third-part evaluator. The evaluator will access not only the quality of individual modules of training, but also examine broader project concerns, such as university enrollment growth, educational curriculum expansion, and increased school district participation rates.

Additional Resources to Ensure Success of the Program

The following agencies and program areas maintain a commitment to provide supporting services and funding to sustain the efforts of the project: (a) National Computer Systems provides appropriate software and on-going training to ISU educational administration faculty, (b) the Office of Professional Development for Schools provides supplemental funding to ensure appropriate staff development in Regions 4, 5, and 6, (c) the ISU College of Education technology program area provides technology support and basic maintenance of computer hardware, and (d) the ISU Instructional Technology Resource Center provides on-going professional development in the use of new technologies for educational administration faculty.

Cost Benefit Ratio Analysis

The following cost-benefit analysis contains three components: (a) identification of relevant costs and benefits, (b) measurement of costs and benefits, and (c) comparison of costs and benefit streams accruing from the start of the project to the break-even point (2.5 years). The costs and benefits of the proposal are presented below:

	Year			
	0	1	2	2.5
Benefits *	---	$44,184	$44,184	$22,092
Costs *	$101,600	$ 4,000	$4,000	$4,000
Net Benefits		$40,184	$40,184	$20,092

*Costs: The initial outlay was $101,600 in year 0. A stream of net benefits equal to $40,184 ($44,184 - $4,000) is expected for each of two years and $20,094 for one half year. The cost of annual maintenance of hardware, supplies and materials, and travel is $4,000.
*Benefits: A degree 3 credit course added to the educational administration program area over the course of two semesters generates $22,464 in university tuition (30 students x 2 semesters x $124.80 per credit x 3 credits). A continuing and/or degree 1-credit course offered to school administrators at school sites yields $18,720 in university tuition ($124.80 x 150). Fifty building administrators per site receive three workshops annually (3 x 50).

Table 1: Costs and Benefits of the Idaho Administrative Technology Leadership Center

Conclusion

The ISU educational administration program area presently serves the following: (a) approximately 30 masters students per semester, (b) approximately 30 doctoral students every three years, (c) fifty-five school superintendents, and (d) approximately 258 site administrators (principals, vice-principals, etc.).

School principals and superintendents increasingly take responsibility for technology and other innovations in our schools. No amount of technology implementation will be successful until our universities support public schools, and we strengthen the training of school administrators in the use and knowledge of educational technologies. As administrators improve their technology skills and their conceptual knowledge of how technologies can restructure education, we move closer to the reality of school reform and the improvement of instruction and achievement for the children of Idaho and the nation.

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Training Preservice Teachers to Become Technology Leaders

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Abstract: This presentation describes a preservice teacher education program for non-traditional students at the master's level. Seminars that support the teacher candidates through their preservice and first inservice years are described. The seminars are used to build technology skills, instructional strategies integrating technology, and teaching portfolio development. Activities that support technology skill and application development during the seminars and the classroom residencies have been found to make these students leaders in technology in their residencies and in their first teaching assignment.

The Initial Teacher Education (ITE) program at the University of Colorado at Denver is an innovative preservice teacher preparation program designed for adults wishing to change careers and become educators. The graduate students or teacher candidates are placed in partner schools for a full year of residencies, working with K-12 students, classroom teachers and school staff. In addition to the residencies, they take university courses and complete a teaching portfolio to qualify for their basic teaching license.

Teacher candidates also work with university faculty in a leadership area to develop specialized skills. While all teacher candidates in this program develop basic educational technology skills, those in the Information and Learning Technologies Leadership Area focus on developing more advanced skills that will enable them to become technology leaders in their school. These teacher candidates are selected for this leadership area for their willingness to learn more about technology and its applications in education. Some have been video producers, web designers, and self-taught computer whizzes and already know a lot about how to use technology. Others come to the program with minimal to non-existent experience with technology. These teacher candidates are encouraged to take an introductory technology class before their residencies begin.

Over a period of two years, the leadership area professors regularly meet with their teacher candidates for leadership area seminars. While some seminar time is spent on increasing teacher candidate knowledge of technologies commonly used in schools, the majority of time is spent examining how technology can be integrated into the school day and exploring innovative uses of technology. Monthly assignments require the teacher candidates to develop presentations, evaluate software, and design plans for using technology. In their residencies, teacher candidates are expected to carefully consider the media they choose to use in the lessons they teach. They are required to teach at least one lesson during each of the three residencies that includes an innovative use of the technology available at their school.

We are now in the fifth year of this program and can see the effects of our teacher candidates on the teachers they work with, the partner schools in which they were placed, the ITE program and their fellow students, and the schools where they eventually become teachers. Teacher candidates are often the first to use technology in a classroom and serve as models for the teachers they work with. When working on group projects with teacher candidates from other leadership areas, the use and integration of technology takes on a higher priority because of their advocacy. The majority of these teacher candidates become technology leaders in the schools where they obtain their first teaching positions and most are immediately drafted to serve on the school's technology committee.

Regional Educational Technology Assistance: A Statewide Professional Development Program

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Abstract
The Regional Educational Technology Assistance (RETA) Program currently consists of a successful statewide professional development model for teachers, administrators and other educators that has had a positive impact on almost all of New Mexico's school districts, as well as numerous private and federally funded schools. Gadsden Independent School District has recently been awarded a U.S. Department of Education Technology Innovation Challenge Grant on behalf of a statewide consortium to expand the RETA Program. The New Mexico Technology Innovation Challenge Grant – RETA Program will focus efforts in the following areas: I. professional development of preservice and inservice teachers, II. advocacy development of administrators and policy makers, III. development of regional resource centers at institutions of higher education, IV. curriculum development and dissemination, and V. sustainability.

Background

In 1994 the New Mexico Legislature passed the Technology for Education Act that established the New Mexico Council for Technology in Education. The Council in turn developed the state technology plan to integrate technology into schools in support of local, state, and national goals. The plan, *Roadmap to School Improvement* (1995), made recommendations to develop both a human infrastructure (professional development of educators) and a technology infrastucture (hardware/software). In 1995 funding for one year was set aside to begin a regional support network that would be responsive to professional development needs. These monies helped pave the way for the development of the Regional Educational Technology Assistance (RETA) Initiative. RETA's mission was, and is, to establish a human infrastructure, at both local and regional levels, of teachers and administrators who are familiar and comfortable with educational technologies and their uses.

The RETA Initiative began in order to establish a network of educators throughout the state to assist New Mexico districts with technology planning and implementation. Building on the successes of the first year, the focus shifted from working with technology planning toward developing a deeper, more meaningful understanding of how to use technology for teaching and learning. For this new focus, the RETA model was based on research that suggests teachers learn best from skilled peers (Fulton, 1996; Grant 1996; Norton & Gonzales, 1998). Using exemplary curriculum models that can be adapted for local use, and supported by a network of professionals who understand adult learning and educational systems, the RETA Initiative provided opportunities to New Mexico's teachers for professional development in the integration of technology to support student learning.

Results from the past two years of evaluation data indicate that RETA has met and in many cases exceeded expectations by providing: a core team of peer educators skilled in providing technology integration workshops for classroom teachers statewide, a statewide network of peers capable of providing continuing support, a statewide network of educators to assist with technology planning and implementation, peer workshops on how to integrate technology to support educational goals, exemplary curriculum models adaptable for K-12 classroom application, and communities of learning where skilled educators share their knowledge to promote student learning. The RETA evaluation results indicated that teachers need ongoing support and sustained learning opportunities to develop their skills and confidence using technology in effective instructional environments. Administrators play a key role in shaping these environments; however, they often lack the in-depth understanding of the value of technology supported instruction and collaborative approaches to new content and learning environments (Norton & Gonzales, 1998).

As a component of the RETA Initiative, the Administrator's Leadership Academy was developed to establish a community of administrators to work together to meet real needs, heighten awareness, and focus on

new designs for learning with policy discussions and systems changes guided by promising practice. Research supports the notion that school administrators are catalysts who shape the vision, set direction, and model changes that current educational reform efforts reflect (Hawkins, Panush, Spielvogel, 1996).

RETA currently consists of a successful statewide professional development model for teachers, administrators and other educators that has had a positive impact on almost all of New Mexico's school districts, as well as numerous private and federally funded schools. Gadsden Independent School District has recently been awarded a U.S. Department of Education Technology Innovation Challenge Grant on behalf of a state consortium to expand the RETA Program. The New Mexico Technology Innovation Challenge Grant – RETA Program will focus efforts in the following areas:

I. professional development of preservice and inservice teachers
II. advocacy development of administrators and policy makers
III. development of regional resource centers at institutions of higher education
IV. curriculum development and dissemination
V. sustainability

I. Professional Development of Preservice and Inservice Teachers

The primary goal of the *professional development of preservice and inservice teachers* is to expand the statewide network of educators skilled in the effective use of technology to support educational goals. The RETA Program is providing high-quality professional development activities that are based on the "Mission and Principles of Professional Development" set forth by the U.S. Department of Education. These principles point out that good professional development focuses on local needs in the context of state and national goals, notes the importance of alignment with ongoing systemic change, emphasizes the involvement of prospective participants in the planning process, acknowledges the need for curricular immediacy and relevance, and evaluates for effectiveness. The goal of this focus are will be achieved by:

- expanding the cadre of peer educators who present on-site workshops that are grounded in research, promising practices, and results;
- expanding the number of teacher participants in workshops provided throughout the state;
- adding a mentoring component that provides appropriate online "courses" which augment the workshops and allow participants to better share their new knowledge with peers and preservice teachers, thereby leveraging the instruction provided;
- preparing teachers to work in their districts as "trainer of trainers" to expand professional development opportunities; and
- supporting teachers as they train colleagues in their local areas.

As the teacher participants become comfortable with technology they return to their local districts and provide inservice training to their colleagues. This is based on the "train the trainer" model which has proven to be quite successful (Ingwerson, 1996). All professional development activities in this project focus on the improvement of student learning. Supporting and strengthening the statewide network of technologically literate educators impacts student learning through the effective and appropriate use of technology to deliver engaging, thought provoking instruction.

Professional Development of Educator's Impact

Forty master educators were identified as RETA instructors. The instructors met, along with project directors, to develop new curricula for the workshops. The curriculum is based on best practices that promote student achievement. The instructors delivered workshops in most of the districts throughout the state. Workshops were held from October through the Spring based on individual schedules. Presentations topics/modules include: Telecommunications/Email; Desktop Publishing and Graphics; World Wide Web/WebQuests; Multimedia Applications; Integrated Packages; and Media Literacy. The curriculum modules are being made available on the RETA website at http://reta.nmsu.edu/curr_links.html.

The RETA curriculum is designed specifically for direct transfer to the classroom. Each workshop module is capable of immediate application and with approximately 400 teachers attending 6 workshops each, 2000 new or adapted learning activities have been instituted in New Mexico's classrooms. Participants workshops incorporated the modules with their lesson plans and presented their students with technology integration activities suited for their particular goals.

Through the modules presented in the RETA workshops, content and method of delivery were modeled for New Mexico educators, who in turn modeled them for New Mexico's students. Instruction and technology use have changed in the classrooms of the workshop participants (Norton & Gonzales, 1998). Student learning activities have been redesigned to include the use of technology as an effective research and learning tool. This impact has occurred at all levels and in varied types of classrooms, from special education to teacher inservices. The RETA workshops have directly affected, with positive influence, student learning.

Because of the geographical distances, one of New Mexico's greatest challenges is connecting educational districts. The RETA program is specifically designed to address this challenge by establishing networks both within districts and among them. Teacher participants reported that one of the most useful aspects of RETA workshops was the ability to network and share with colleagues in their own and other nearby districts. They also stated that there was more collaboration with peers. Participants confirm this and other areas of impact in their enthusiastic expressions on the session evaluations given at the end of each workshop.

II. Advocacy Development of Administrators and Policy Makers

The primary goal of the *advocacy development of administrators and policy makers*, is to develop the capabilities of the administrators and policy makers to become technologically literate educational leaders. If New Mexico students are to succeed in meeting educational goals and if schools are to be successful in meeting central objectives of educational reform, district and building level administrators must understand the impact of technology on teaching and learning and the need for comprehensive strategic planning and action. To support the goal, the following objectives were developed:

- familiarize administrators with learning technologies;
- inform administrators about issues related to equity, student learning, funding, professional development, and curriculum integration;
- familiarize administrators with the available resources; and
- practice identifying and using appropriate technologies to meet a variety of educational needs.

It is the belief of Steve Sanchez, New Mexico's State Technology Director and one of the organizers, that, "the [Leadership Academy] goal will be achieved not merely by equipping administrators, but by encouraging (them to develop) a vision of leadership which clearly identifies key issues in the successful implementation of technology and builds the human infrastructures necessary to see through the best plan for the state" (Milken Exchange, 1998).

Leadership Academy

A design team met to develop the plan for the Leadership Academy and identify resources needed to conduct the proposed activities. Design team members represented the State Department of Education, the New Mexico Council on Technology in Education, New Mexico State University and Los Alamos National Laboratory. The Milken Family Foundation (MFF) joined as a partner to help initiate the online structured discussion that would help the administrators better understand the impact of technology on teaching and learning and the need for comprehensive strategic planning and action.

Eight local facilitators were chosen to work with the administrators and a meeting was held to provide a framework for the Academy. At that time, the New York based Center for Children and Technology (CCT) was brought in by the MFF to help conceive the "online" portion of the Academy and guide the development of the facilitators and the design of several content pieces for the administrators. The use of electronic communication was intended to increase interactivity so participants could share local opportunities and hurdles with one another and discuss their own particular circumstances and difficulties.

The program was launched at an orientation session for approximately thirty district administrators representing schools throughout New Mexico. This meeting was designed to bring the administrators together for the presentation of the goals and structure of the Academy and to form working teams. The administrators worked in small groups with the eight local facilitators.

> "Give me a carburetor or a fuel pump and I know what I'm doing. But routers and TCP and these things... I'm lost."

This was the opening comment of a representative from a tiny rural school district in eastern New Mexico. He was one of about 30 administrators who gathered at the start of the first of the state's Leadership Academies. Over the next eight to ten week period participants in the Leadership Academy used email, listservs, the World Wide Web and live electronic discussion boards (part of the Milken Exchange's technical support for the program). CCT, working with the facilitators and MFF, initiated an online discussion based on several scenarios developed after talking to administrators in three New Mexico districts. Many of the administrators had difficulty entering into these discussions due to problems with connectivity, familiarity with electronic communications, and applicability to their local issues. In response, a web-based format was developed. However, this occurred late in the academic year and most administrators were very busy with end-of-year deadlines which significantly limited discussion time.

The follow-up workshop brought administrators face to face again to share progress reports, set future goals, and gather feedback on the effectiveness of the Academy. They were also asked to identify key elements in successful technology plans (using technology and working in teams) and to use this information as the basis for writing a proposal. A goal for this session was to reinforce the effective use of web resources and connect this to the major issue of funding.

Leadership Academy Impact

> "...we work so hard securing the money to buy the 'stuff,' we sometimes don't have the energy left to learn how to use it well!" -David Livingston, Guest Speaker for Online Academy.

The face-to-face sessions were very productive and administrators mentioned how important it was for them to get together and share strategies and ideas. As a result of these sessions several administrators have established local collaboratives where neighboring districts are helping one another with some common concerns. Many administrators indicated that, as a result of the Academy, they were now using Email and had started accessing some web resources. This was a major step for many administrators who typically have not had the first-hand technology experience that many classroom teachers have had. We have now begun the second year of the Leadership Academy with first year participants acting as mentors. District administrators from throughout the state recently attended the **Administrators' Institute on Technology** at Santa Fe Community College, Santa Fe, NM. The theme of the Institute was ***Educational Change and Technology*** and the program provided a number of workshops and information sessions that included: *The Internet and Learning Frameworks, Applications of Technology for Administrators, Managing Project and Budgets, State Department of Education reporting requirements, E-rate and NM Schools, Successful Technology Grant Writing,* and other topics related to leading funding decisions and the use of technology to impact student achievement.

III. Development of Regional Resource Centers at Institutions of Higher Education

The primary goal of the *Regional Resource Centers* is to sustain the professional development opportunities for educators in their local regions, and b) to work with preservice and inservice faculty to understand how to modify their instruction to reflect and model effective integration of technology. Through a process of Request for Proposals (RFP), two instititutions of higher education in New Mexico, chosen in January 1999 will develop the first Regional Resource Centers (RRC). During the life of the project six more institutions will be selected to develop RRCs. These Centers will work with both teacher preparation programs and local districts.

The Office of Technology Assessment (OTA, 1995) reports, "...most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice." Resources in the Regional Centers will be available to faculty to provide methods and activities for integrating meaningful technology content into their courses.

Regional Resource Center's coordinators are local educators who have a thorough understanding of the skills and practices necessary to the development and implementation of effective technology-supported learning environments. University students work on-site with regional teachers helping to connect the technology resources of the Center with K-12 teachers' needs. Local teachers will have opportunities to become technology specialists working directly with the Center and their colleagues on specific projects and

applications. Through these Centers, parents and community members, teachers, administrators, collegiate faculty and students, and other individuals will have equitable, free access to communications, information, and educational technologies. This two part goal will be achieved by:

- guiding and supporting faculty in teacher preparation programs in effective integration of technology into their course work;
- initiating research efforts to promote a better understanding of the role technology plays in impacting the efficacy and cost-effectiveness of K-12 education;
- establishing sustainable networks of local and regional experts available to help schools as they plan, implement and evaluate their technology initiatives;
- engaging parents, community members, and business partners in understanding the role technology can play in preparing New Mexico students for successful futures;
- encouraging the participation of parents, community members and business partners providing access to exemplary curriculum content appropriate for New Mexico's diverse student populations; and
- developing and delivering workshops and courses that enhance teachers' skills in the use of technology in K-12 classrooms.

IV. Curriculum Development and Dissemination

The primary goal of *curriculum development and dissemination* is to develop and disseminate curriculum models and web-based materials that reflect exemplary practices and are explicitly linked to local, state and national standards. The curriculum is an integral part of all components of the RETA Program and acts as a framework for the development of all content, methodologies and assessment elements. Developing and disseminating exemplary curriculum provides teaching materials that integrate technology with content to improve the acquisition of knowledge for students' roles in learning, living, and working in the information age. Following the acquisition of appropriate hardware and software to support the web-based materials, the process will proceed to:

- select and prepare staff to develop and maintain web-based curriculum products;
- provide appropriate staff support for multimedia development; and
- disseminate exemplary curriculum products to educators throughout the state via online resources and networks, and collaborate with project partners to disseminate and evaluate curricular materials and resources.

The curriculum resources that have been developed thus far are available at the RETA website: http: http://reta.nmsu.edu/curr_links.html.

V. Sustainability

The primary goal for *sustainability* contains two parts: a) To create a critical mass of educators who can effectively deliver instruction to their peers on a continuous formal and informal basis; and b) to institutionalize the goals and processes of this project under the auspices of the NM State Department of Education (SDE). The purpose of the RETA Program is to establish working models of educational technology integration in all of New Mexico's school districts. This project will leave a legacy of self perpetuating curricular and professional development centers in order to strengthen and support the capacity of New Mexico districts to provide ongoing effective professional development.

To address sustainability, the Regional Resource Centers will operate under agreements that set forth a mechanism outlining how the college/university will ultimately assume the operation of the Centers. These agreements will be developed through a facilitated process that includes the Regional Center Coordinator, the IHE Representative, and the RETA project staff. This alliance will provide a stable hub from which curriculum and trainers can be disseminated and feedback from participants can be received and processed. Additional benefits from the RETA Program will include:

- a collaborative permanent architecture of partnerships maintained through NM Council of Technology in Education;

- the RETA model which can serve as a guide to professional development in future local and state programs;
- an evaluation process to inform and bring about common thinking regarding professional development;
- an established infrastructure in each district for continued professional development; and
- continued availability of web-based and electronic materials.

The NM TICG/RETA Initiative responds directly to the state technology plan's vision and mission statement. The goals in each of the five focus areas are based on previous experience and research in the field of technology and professional development. The design of the model based on teachers-teaching-teachers will ground learning experiences in the culture of teaching. Peer educators, who are themselves technology integrating classroom educators, communicate the possibilities of technology use while simultaneously recognizing the realities of schools and classroom practice.

Conclusions

The Regional Educational Technology Assistance Program set forth the goal of providing New Mexico's educators with on-site professional development in the area of technology integration. To that end, the workshops and academy sessions have delivered relevant, classroom-ready curricular models, provided exploration of technology planning and policy making, and influenced the teaching and learning styles in classroom environments.

Peer instructing has set a model for continued technological training in each school district by adopting and adapting the "teachers teaching teachers" or "trainer of trainers" method. Administrators have been exposed to and discussed the need for methods of continued professional development opportunities for both educators and administrators. Curricular modules have been developed for classroom use; and, teachers have been given the skills needed to teach technology as tools for learning. Students have been shown that technology is a tool for exploration, discovery, communication, and presentation.

Through the collaboration of its partners, RETA has facilitated the missions of the *Road Map to School Improvement: New Mexico Plan to Integrate Educational Technology into Public Schools in Support of Local, State and National Goals, Goals 2000,* and many school districts' technology plan. It has also begun the development of the human infrastructure necessary to fully integrate appropriate technology into the learning process. Workshops have impacted approximately 900 teachers, 20,000 students, and over 60 administrators from New Mexico's educational institutions.

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Perceptions and Educational Technology Needs of School Administrators

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Abstract: The purpose of this paper is to provide a comparison of studies regarding administrators' needs and perceptions related to technology in education. A synopsis of educational technology standards that have been applied to students, teachers, and administrators in the Commonwealth of Virginia and standards being considered by the Southern Regional Education Board are also used to inform general recommendations for administrators' technology training needs.

1. Introduction

While the need for improved technology training for teachers has seen increased attention in recent years, the training needs of pre-service and in-service school administrators has received minimal attention. Telem (1991) suggests that issues related to Instructional Technology development for school administrators have been ignored for the most part, with limited attention "in the literature, at scientific meetings, and among special interest groups in professional associations in education" (p. 595). Despite this lack of attention and training administrators are still faced with the increased responsibilities of infusing technology into the schools under their charge. "The importance of technology and computers has increased tremendously in the last few years as superintendents are pressured to purchase the latest equipment, hire computer coordinators, train teachers to use the equipment, and connect everything to the network" (Sharp & Walter, 1997, p.8). If administrators are to successfully fulfill these tasks instructional technology must "become an integral part of the curriculum of universities and other institutions preparing school administrators" (Telem, 1991, p. 605). With training there is the possibility of "using [Instructional Technology] as an aggressive educational leadership tool and a proactive management tool" (p. 605). Unfortunately, many of the technology courses that have been offered for school administrators have emphasized skills-based training. While some of these courses have been successful, many have failed to provide the comprehensive experience that administrators need.

2. Needs and Perceptions

Studies have indicated that knowledgeable school administrators contribute significantly to the proper integration of technology (Beach & Vacca, 1985). Technology training for instructional leaders is vital (Bruder, 1990) to the successful infusion of technology into the daily instructional and administrative routine of our public schools.

> Principals...must have a solid 'base of knowledge' to draw on, whether they're setting budgets and standards for their schools, implementing system-wide

technology plans – or, just trying to keep pace with staff and students (Rockman & Sloan, 1993, p. 2).

Through informal discussions with fellow administrators Brooks (1997) found that the majority were concerned with the acquisition of technology rather than what would take place after the technology arrived. She suggests that principals need the knowledge to make more informed budgeting decisions that include a stronger emphasis on providing professional development opportunities for teachers. Staff development has been identified by many studies as a key component to the successful implementation of technology (Costello, 1997). Brooks believes that both teachers and administrators need to realize that the successful implementation of technology into instruction will require changes in instructional approaches as teachers become facilitators of learning rather than distributors of knowledge.

Administrators, as instructional leaders, "need to develop the understanding necessary to guide their instructional technology programs and to have the hands-on experiences that training on administrative uses of technology provides" (Beaver, 1991, p. 1). Beaver used mailed surveys to gather information from building, district, and state level administrators regarding their technology competence. While 70% of respondents indicated the importance of computer use to their success on the job, 73% indicated having little or no technological competence. Additionally, 77% reported that they had not participated in technology training. These results informed his recommendations for elements to be included in a technology course for administrators. Beaver suggests practical applications of productivity tools, group discussions of relevant technology issues, and individual and group projects that allow participants to develop skills that meet their needs and interests.

> Without the hands-on experience, discussions become remote, second-hand experiences. Without the discussions, the hands-on experiences degenerate to software training workshops. Without the discussions and hands-on workshops, the project presentations become 'Show-And-Tell' sessions. Together, the three components provide a solid foundation for an administrative computer leadership capable of guiding us steadily into the next decade (p.13).

Beach and Vacca (1985) suggest that as technology leaders administrators will deal with "effective methods of implementing micro-computer-based instructional programs" (p. 31). The purpose of their study was to identify the role of administrators in the implementation of technology in high schools identified by the Southern Association of Colleges and Schools as using computer technology. High school principals in six southern states responded to a demographic questionnaire and *Leader Effectiveness and Adaptability Description* survey. The demographic questions sought to determine numbers and instructional use of computers, technology planning and management, professional development for teachers, and the administrators' technological competence. Beach and Vacca found that administrators' responses to items regarding the "functional utility" of computers in education were distributed among choices of "limited", "technological fad", "vital innovation", "part of program", and "no response" (p. 36). The majority of responses indicated that computers were an important part of the school program. The *Leader Effectiveness and Adaptability Description* was used to measure administrators' leadership style. Most respondents were categorized as "High Task-High Relationship", which implies a flexible and adaptable leadership style. The authors believe that "successful implementation varies directly with the adaptability of the administrator" (p.44).

The *Technology Survey for Principals,* developed by Heaton and Washington (1998) was distributed to administrative interns as a pilot test of the instrument. The instrument was developed to determine relevant issues related to technology policy, the principal's role as a technology leader, and personal technological competence. Participants were asked to rank the relevant issues in order of their importance. Additional items were included to identify specific issues and skills related to the three ranked items. Half of the respondents ranked personal skills as most important, however, 93% of participants ranked learning to be an instructional leader as either first or second. The development and implementation of a technology plan that includes strong support for technology training related to helping teachers meet state technology standards were among the highest rated issues. Technology training for pre-service administrators should emphasize the importance of becoming a technology leader. Course content should provide an awareness of ways to encourage instructional and administrative technology use, hardware and software requirements needed to support uses of technology, and ways to support teacher participation in technology training. Technology issues related to the development and implementation of a school technology plan should be discussed throughout the course. The interest in developing personal skills should be addressed through

completion of context-based projects that allow administrators to develop skills relevant to their daily routine.

3. Comparison of Studies

The purpose, results, and recommendations discussed in section two above are outlined in Table 1.

Purpose	Results	Recommendations
To look at the administrators role in technology planning Based on informal discussions with fellow administrators Brooks (1997)	• Principals often focus on acquisition of technology • Principals have little knowledge of the technology purchased	Principals need to: • Make informed budgeting decisions • Recognize the ability of technology to change/ improve education • Play "an active role in the planning and implementation of technology" (p. 30) • Create professional development opportunities for teachers
To determine the technology competence of administrators and make recommendations regarding technology course content 59 of 75 administrators in West Central Florida completed a 36 item mailed survey Beaver (1991)	Participants reported: • Little or no technological competence • Competent computer use as important to success on the job • Little or no technology training	Administrators need: • Practical applications of productivity tools • Group discussions of relevant technology issues • Individual and group projects to develop skills that meet their needs and interests
To identify the role of administrators in the implementation of technology 231 of 309 high school principals in six southern states with an identified interest in integrating technology responded to a demographic questionnaire and *Leader Effectiveness and Adaptability Description* survey Beach & Vacca (1985)	• Computer use is an important part of the school program • Principals ranked high on the "High Task-High Relationship" leadership style • 84% of principals rated themselves as novice computer users	Administrators should be flexible and adaptable in order to successfully implement educational technology
To determine relevant issues related to technology policy, the principals role as a technology leader, and personal technological competence 14 of 16 administrative interns enrolled in a technology course at the University of Virginia completed the *Technology Survey for Principals* Heaton & Washington (1998)	• 7 of 14 (50%) ranked personal skills as most important • 6 of 14 and 7of 14 (93%) ranked learning to be an instructional leader as first or second respectively Among the topics rated as most relevant to the administrator's role: • Development and implementation of the school technology plan • Ways to support technology training for teachers • Funding and selection of hardware and software • Supporting instructional applications of technology	Administrators need training that includes: • Ways of becoming an instructional leader • Context based skills development • Discussions of relevant technology issues

4. Technology Standards for Students, Teachers, and Administrators

In June 1995, the Virginia Board of Education approved Standards of Learning (SOL) in four core content areas - mathematics, science, English, and history and the social sciences. The standards in the core content areas include benchmarks describing the technology skills and knowledge students should acquire by the end of the 5th and 8th grades. Minimum competencies at the end of grade five include:

- knowledge of technology terminology
- keyboarding skills
- operating peripheral devices
- accessing information from electronic databases
- integrating graphics in word processed documents
- creating simple spreadsheets and databases

While the standards also require students to be able to "apply technologies to strategies for problem-solving and critical thinking," (http://www.pen.k12.va.us/go/Sols/home.shtml) they are strongly skills-based, rather than content-based competencies. By the end of the 8th grade, students are required to demonstrate the following competencies:

- composing and editing a multi-page document
- communicating with spreadsheets by entering data and setting up formulas
- analyzing data and creating graphs or charts to visually represent data
- communicating with databases by defining fields and entering data, sorting and producing reports in various forms
- using advanced publishing software, graphics programs, and scanners to produce page layouts
- integrating databases, graphics, and spreadsheets into word-processed documents

Additionally, students should be proficient in communicating via e-mail and creating web pages. In the spring of 1997, the state began administering stand-alone technology tests corresponding to the standards.

In September 1995 the Board of Education requested that ABTEL (Advisory Board on Teacher Education and Licensure) "examine the issue of technology proficiencies as a requirement for licensure for instructional personnel" (http://www.pen.k12.va.us/go/VDOE/Compliance/TeacherED/tech.html). Instructional personnel refers to all school personnel required to hold a license issued by the Virginia Board of Education for instructional purposes. A task force was organized to make recommendations regarding technology proficiency for licensure to ABTEL. The proposed and adopted recommendations are referred to by the Board of Education as "Technology Standards for Instructional Personnel." Local school divisions and institutions of higher education are expected to develop plans to implement and assess these standards by December 1998.

Technology Standards for Instructional Personnel require teachers to demonstrate competency in the following areas:

- operating a variety of computer systems and accompanying peripheral devices, utilizing instructional, application tools, productivity, and courseware software programs, and troubleshooting general hardware and software problems
- applying knowledge of educational computing and technology terminology
- using software tools to assist with administrative tasks, development of instructional materials, correspond with students and parents
- using telecommunications software
- incorporating word processing, spreadsheet, or database software in instruction
- using presentation and/or authoring software
- using computers, modems, networks, printers, large- group presentation devices, scanners, digital cameras, camcorders, video cassette recorders, optical disc players, etc.
- using educational technologies for data collection, information management, problem-solving, decision making, communications, and presentations within the curriculum.
- using multimedia, hypermedia, and telecommunications software to support individual and/or small group instruction; as teaching assignments dictate
- abiding by copyright laws, practice responsible uses of technology

In the fall of 1998, the Southern Regional Education Board proposed "Technology Standards for School Administrators." Several key areas of technology competence were identified as being crucial to administrators' ability to take a leadership role in the creation of technology related programs. The proposed standards include the administrators' ability to:

- understand the elements and characteristics of long-range planning for the use of current and emerging technology
- demonstrate ability to analyze and react to technology issues, concepts, and proposals
- possess a "big picture" vision of technology in education and schools
- use technology to efficiently communicate with stakeholders
- use technology to collect and analyze data and other information to improved decision making and other management functions
- understand how current and available technologies can be effectively integrated into all aspects of the teaching and learning process
- understand the legal and ethical issues related to technology licensing and usage

5. Recommendations Regarding Administrators' Technology Needs

The suggestions provided by the review of research and the technology standards discussed in section three of this paper are intended to guide the development of general recommendations for technology training for administrators. The recommendations are divided into three main sections including: understanding technology management issues, the impact of technology on educational change, and administrative uses of technology, however, they are not intended to be an exhaustive list of administrators' technology needs. Highlights of each section are as follows:

- Understanding technology management issues
  - providing proper funding for training and support
  - managing software and hardware acquisition and upgrades
  - technology planning
  - budgeting for technology training and support
  - knowing technology standards for students and instructional personnel
  - participating in the development and implementation of the school/district technology plan
  - developing personal and staff development programs
  - comprehending ethical and legal issues related to technology use
- Impact of technology on educational change
  - create a supportive environment for change
  - support changes in instruction that encourage teachers to become facilitators of learning
  - learn ways to encourage students to take a more active role in their own learning
  - develop long range plans that adapt the vision/mission of the school to include the infusion of technology across the curriculum
- Administrative uses of technology
  - learning ways to communicate with students, teachers, and parents
  - analyzing and organizing data to make informed decisions
  - encouraging teachers' administrative use of technology
  - utilizing Internet resources for personal professional development
  - staying abreast of current literature in instructional technology and related fields

"If we expect our administrators to provide the vision and understanding needed to guide the development of instructional computing programs, we must encourage them to increase their computer competence" (Beaver, 1991, p.4). Training for administrators must include a comprehensive experience with practical applications as well as discussions of pertinent issues related to the implementation and support of technology. Such training will encourage maximum integration of technology into the daily performance of administrators.

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Principals and Telecommunications: Needs and Suggestions for What the Web Has to Offer

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Abstract: This paper is a review of literature related to the changing professional development needs of principals and the potential of the World Wide Web to meet some of those needs. Research indicates that principals need greater access to information and people who can assist in their professional development and daily decision making responsibilities. The Internet has the potential to provide not only a wealth of information resources but also a collaborative environment that is not limited by time and location.

1. Introduction

In the rapidly changing world of the Communications Age principals, as leaders of their schools, need access to information and people who can assist in their professional development and daily decision making responsibilities. Research has shown that the Internet, or more specifically to this paper, the World Wide Web (WWW), can provide a collaborative environment that breaks down the barriers of time, place, and space (Cutler, 1996).

2. Needs: Information and Collaboration

During the past several decades schools have undergone a number of changes. Principal preparation and professional development programs are faced with finding new ways to prepare principals to meet the challenges brought on by curriculum and policy changes, community and social demands, and technological advances (Phay, 1997; Ricciaridi, 1997; Zellner & Erlandson, 1997). Zellner and Erlandson emphasize the point, by stating:

> Successful principals will need increased knowledge to correspond to the growth of the schools' responsibilities and, even more important, they will need new skills for acquiring that knowledge and applying it to the process of education. (1997, p. 46)

Ricciardi (1997) reports that a survey of South Carolina principals indicated the following concerns that principals have about typical professional development programs. Principals indicate concern regarding

- time to attend training sessions,
- topics covered during training sessions ,
- proximity to training locations,
- communication with others throughout training, as well as before and after training, and
- continuation of support following training.

Similar research of Indiana's Principals' Technology Leadership Training Program found that in addition to training "[t]he availability of a statewide electronic network would also permit educators to share ideas, ask questions, establish a wider community, and exchange e-mail, as well." (Rockman, & Sloan, 1993, p. 17). The Principals' Executive Program (PEP) in North Carolina has yielded similar results in establishing the need for networks of "friends and colleagues all across the state to whom they can turn for advice and strength when a problem arises in their school" (Phay, 1997, p. 55). In *The Wired Principal*, Donatucci discusses the importance of "the ability to locate, communicate, and process information" that will allow principals to "become more proactive in approaching administrative challenges" (1995, p. 14).

3. Suggestions: The World Wide Web

The World Wide Web interface may prove beneficial to meeting some of the needs. The web certainly has the ability to alleviate some of the time, proximity, and communications needs identified above (Cutler, 1996; Sussex & White, 1996). Access to current research and information interchange between individuals in different locations can take place quickly and easily. The ability to ask questions and share ideas with individuals having common interest (Ashley, 1992) can be highly beneficial in promoting professional growth and creating the support network that administrators need. The information resources available over the Internet can contribute "to minimizing the lack of access to expertise, materials, advice, [and] collaboration" (Sussex & White, 1996, p. 201). Trentin states that, "Interaction between participants promotes the group's collective growth" (1997, p. 24). I believe that this holds true whether the group is face-to-face in a classroom, or computer to computer through e-mail and discussion groups. The common space provided through the web and discussion group format promotes sharing.

> Asking questions, initiating messages and all the various responses are available to all participants. As a result of these exchanges, individual expertise and experience become shared knowledge (Barnes, & Greller, 1994, p. 134).

Using the Internet as a means of communication is also a cost-effective (Zellner & Erlandson, 1997) medium.

3.1 Site Components

Through the web interface there is the potential to address both information and collaborative needs of principals. Trentin (1997) suggests that,

> Any logical communication structure aimed at collaborative distance learning will involve two vital elements: firstly, mailing lists and electronic boards that allow multi-channel interaction between the members of the work or study group; and, secondly, shared information space which can be accessed by the whole group (p. 19).

In another article by Trentin (1996), he suggests that the communication structure should include "interpersonal communication" (e-mail, newsgroups), "remote access to information" (web links to various information and resources), and "sharing" (p. 11) achieved by a combination of the first two items.

3.2 Site Development

In order to create and maintain a beneficial web-site, research should be conducted to give users the opportunity to provide feedback that will be valuable in informing site designers. Morris and Ogan recommend that in conducting mass communications research, researchers must implement "a range of uses-and-gratifications-based questions concerning audience" (1996, p.43). If a site is being developed to meet needs specific to principals, then it is essential to get feedback from this group regarding their needs and interests. In *The 7 Keys to Effective Web Sites*, Sachs and Stair (1997) recommend that web-site evaluation should include: visual appearance; information or entertainment value; timeliness; ease to locate, use, and navigate; interactivity; and responsiveness to users needs and suggestions.

3.3 Site Promotion

Creating the resources and collaborative network, however, is only the beginning. There is a line in the movie *The Field of Dreams* that says, "If you build it, they will come." Adding a twist to that line, we should ask the question, if we build it (a web-site), will they (principals/users) come? McQuail (1995) writes that potential users need both "exposure" and "encouragement" to facilitate exploration of

networking technologies. Porter (1997) suggests the use of conference presentations, interviews, open houses, press releases, and professional publications for promoting a new web-site.

In his article on the value of the Internet in education, Trentin (1997) discusses the importance of avoiding what he calls the "network euphoria" in which even enthusiastic users begin to lose interest after the initial stage of curiosity. In order to harness the potential of using Internet resources we must be continuously involved in the process of "developing the site and innovation" (Szuprowicz, 1996, p. 41). The Rockman (1993) article, which recommended the development of electronic networks for principals, also suggests that principals will need guidance to get them started and a moderator to keep them going.

5. Conclusion

It has been stated that, "Whether we want it or not, computer technology seems destined to change drastically many of the ways we administer and teach in public schools" (Guthrie, Garms, & Pierce, 1988, p. 297). If we wish to have a positive impact on the technology use of administrators we have the responsibility to seek out their input when creating technology resources for their use. In order to design an effective web-based collaborative group and information resource for principals it is essential to review relevant literature regarding their professional development needs, to be aware of current information on the web related to educational issues and concerns, and to acquire feedback from principals regarding their needs and interests.

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TIMA: The Right Way to Create a Teacher Technology Institute in a K-12 School

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Abstract: Computer technology was introduced into education in the early 1980s. Teaching the teachers how to use this technology to enhance their curriculum has been an ongoing process. Often continuing education is done while teachers balance other responsibilities. To meet the needs of all its educators, Moravian Academy--a K-12 independent school in Bethlehem, Pennsylvania--established the Technology Institute at Moravian Academy (TIMA). TIMA provides a supportive environment for teachers continually to ask questions, seek advice, and learn. In reflecting back on the establishment of TIMA, we recognized that in order to meet the needs of the teachers we needed to take the RIGHT steps towards the future.

The systematic introduction of computers into elementary classrooms began in the 1980's. Dickerson and Pritchard (1981) predicted the interactivity and storage capabilities associated with computers would have a great impact on students and teachers, alike. Researchers studied how to incorporate technology, specifically the computer, into education. School administrators offered workshops and teacher education. Federal grants supported studies about the effectiveness of computers. Many school administrators, however, failed to incorporate adequate staff computer technology training for their teachers into long range plans. Unfortunately, teacher education for experienced teachers lacked administrator support and therefore lacked money (Dickerson & Pritchard 1981). The administrators expected experienced educators to incorporate computer technology into their curriculum. More often than not, however, the computers were used during independent work time and as a reward for students once they had finished their expected seatwork. Few teachers had the time, energy or knowledge to incorporate computers into their curriculum. Although money remains an issue at present, administrators, school boards and educators alike recognize that "providing new learning contexts and models that interest teachers, excite their curiosity, and challenge them to think" (Yocam 1996) plays a key role in motivating teachers, specifically in the area of technology. TIMA (Technology Institute at Moravian Academy) was established to create this type of learning environment.

Continued Professional Development

In 1995 there were approximately 5.8 million computers in public K-12 education (Lowther, Bassoppo-Moyo & Morrison 1998). This was a 600% increase from 1980. Of all the money that was spent for these computers, only 15% was spent on teacher training. According to the CEO Forum (1997), only 6 percent of technology budgets in U.S. schools in 1996-1997 were allocated to technology training for teachers, an average of approximately \$4.18 per pupil. Although the per pupil expenditure is expected to rise to \$6.66 in 1997-1998, this

still accounts for only 6 percent of districts' technology budgets. The Department of Education recommends allocating at least 30 percent to training teachers. Overall, only 3 percent were effectively integrating technology into their educational programs at the time the CEO Forum reported their most recent survey results (CEO Forum 1997). School administrators overlook professional development. School administrators purchase computers without a clear understanding of how to use them in the daily business of teaching and learning. Having a computer in a classroom does not mean it will be used. In 1994 only 15% of educators had at least nine hours of training in educational technology (CEO Forum 1997). However, some teachers resist using technology because of anxiety and fear (McKenzie 1991). Yet McInerney, McInerney and Sinclair (1994) concluded that computer anxiety decreases with computer experiences. Other educators fear that using technology will takes up too much class and preparation time. Some teachers don't want to alter their teaching style. Some educators lack the knowledge and confidence.

As educators, we know, however, the importance of teachers taking part in any systematic plan to incorporate technology into a classroom (Soloway 1996). Soloway described several areas of concentration to insure positive "information age" experiences for K-12 classroom teachers. These areas include:

- Accessible Technologies
- Appropriate Software
- Continued Teacher Education
- Instructional and Curricular Relevance

First, teachers must have technology in their classroom. This accessibility allows teachers to take initiative for their own learning. Second, software must be appropriate for education. Software that is outdated, non-educational or not interesting will quickly bore students and teachers. Third, schools must offer continued teacher education. Teachers taught and treated as adult learners feel they have a role in the future of education and present themselves to their students as confident and knowledgeable. Finally, educators must see that technology can influence teaching, everyday. New technology and new skills must be utilized or they will be lost.

Creating an Institute

We created TIMA with Soloway's (1996) ideas in mind. It was important that the institute serve as an educational tool that would guide us into the 21st century. Therefore, we adopted the "RIGHT" approach to creating a technology institute for teachers.

- **R**esources
- **I**nterest
- **G**oals
- **H**elp
- **T**ime

First, we had to make sure we had the *resources* (R). Hardware, software, teachers willing to teach workshops and money to pay for these necessities were the most important resources we needed. All of our teachers have accessibility to school computers. The majority of teachers have computer with appropriate software in their classrooms. Therefore, they have the resources to take the initiative for their own learning (Soloway 1996). As TIMA develops we would to take Soloway's suggestions and go one step further: make sure that every teacher has a computer at home, as well.

Next, we needed to make sure there was the *interest* (I). Experienced and inexperienced teachers are a key part of TIMA. All of the teachers attending or presenting a workshop do so out of interest and a desire for educational growth. The teachers without an interest in technological will eventually find interest in using technology as the educational goals at Moravian Academy, now established, are fulfilled.

Therefore, we made sure that TIMA had established *goals* that would meet the educational goals of Moravian Academy and more specific goals of our grade- and curriculum-specific teachers (G). Our educators and administration see how technology can influence teaching and education (Soloway 1996).

Once these three criteria had been met, we made sure to establish the availability of ongoing *help* for all of the teachers involved in TIMA (H). Teachers need a supportive environment where they can continually ask questions, seek advice and learn. As Soloway (1996) mentioned, teachers feeling confident with their role using technology in their curriculum will find that they are more knowledgeable in their fields of study.

Our final requirement for establishing TIMA was *time* (T). Teachers must be willing to give of their time during workshops and then beyond. Learning about technology, specifically computer use in the curriculum, is a continual process. When teachers have the technology resources and spend time understanding its use, they find their curriculum becomes more interesting and dynamic. Soloway suggests that once teachers experience the benefits of technology they will become the "evangelists" for its continued use in education (1996).

Results

The creation of TIMA has been positive step in the ongoing commitment to teacher education at Moravian--specifically in the area of technology--and we can serve as a model for other initiatives. We determined that many among our faculty were proficient in a variety of technologies. Therefore, we used this resource to educate others. By using peer tutoring as an explicit example, we were merely formalizing what really had been around for years. Now we were giving this type of education time and commitment. We also made it a priority to find budget money to compensate these teachers, to validate their experience, and to thank them.

TIMA has been in existence for over a year allowing many educators to take advantage of the varied workshops. As one teacher said:

> The technology workshops...have been excellent in strengthening my computer skills and knowledge. I attribute the success of the program to the small classes, hands-on experiences, relaxed atmosphere and the outstanding teachers who inspire and encourage.

Those teaching the courses have been encouraged by the outcomes:

> The opportunity I have had to teach my peers has been very valuable. Through teacher, I have been able to learn more myself.... When we are given the time to learn and utilize what we have in our school we can only grow as educators.

Even the administrators involved have been encouraged by the initial outcomes. As one stated:

> Having our own institute has allowed us to tailor workshops to the needs of our faculty. Not only can we offer sessions that are applicable to our school and the programs we are using but we can offer them at various dates and times throughout the year when they would be convenient for our faculty.

Future Directions

TIMA has some growing to do. For example, TIMA and Lehigh University's Technology-based Teacher Education program are providing an opportunity for inservice and preservice teachers to collaborate on technology integration projects. Field students will engage in classroom observations and, with the experienced teachers, co-develop a piece of instruction aligned with the Moravian Academy curriculum that employs some type of embedded technology. We see this as a positive step toward providing the necessary experience for both Lehigh students and classroom teachers to gain a better understanding of the use of technology in teaching and learning.

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Technology Education that School Principals Want

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Abstract: School principals are called to be lifelong learners. The advancements of technology require school leaders to participate in ongoing education to remain skilled in and informed about technology usage. This article will first provide a literature review discussing the need for continuing education in technology for school administrators as lifelong learners. Secondly, it will discuss the types of technology education principals want, based on data generated from 100 elementary, middle school, and secondary principals. Thirdly, it will describe the types of software available to meet technology needs of school leaders. Lastly, this article will discuss the implications of this study in establishing professional development programs in technology education for school leaders.

School Principals as Lifelong Learners

Lifelong learning should be a practice exercised by all people (Organization for Economic Cooperation and Development, 1996). Niemi (1972) states that lifelong learning incorporates both the processes of learning by design and by chance, and it should not be equated with lifelong schooling. Lifelong schooling implies compulsory education, not allowing the adults to choose the educational areas and approaches to meet their learning needs and styles. Lifelong learning should be designed to meet adult learners' specific, lifelong educational needs for both professional and personal growth (Chickering, 1994; Cross, 1995), serving as a means for self-renewal in an ever-changing world (Collinson, Sherrill, & Hohenbrink, 1994).

School principals are to be continual or lifelong learners (National Association of Elementary School Principals, 1986). In responding to the need for campus leaders to be lifelong learners, the Texas State Board of Educator Certification (1998) proposal provides minimum requirements of continual education for school administrators to maintain their principal certification in the State of Texas. In outlining goals for the restructuring of high schools in the United States, members of the National Association of Secondary School Principals (1996) placed the need for professional development of school educators as one of the nine educational priorities. School administrators and teachers need to model lifelong learning if students are to comprehend the meaning of education (Bush, 1998). For example, Carter (1997) points out that principals must serve as role models for technology usage. The shortened life cycle of technology requires school administrators to maintain lifelong learning (Jones, 1997). Moreover, this ongoing education can strengthen school administrators' "lifelong employability," providing them ongoing productivity and employment, which may not be guaranteed by earlier education (McKenzie & Wurzburg, 1997).

Technology Education for School Administrators

A critical component of principals' professional development is familiarity with technology for both instructional and administrative usage (Beckner, 1990). The professional preparation program should ensure that school administrators are able to demonstrate competencies based on the International Society for Technology in Education (ISTE) guidelines (*Regional Collaborative Center for Professional Development and Technology Proposal,* 1992, p. 4B-6-7). Guidelines include being able to "demonstrate the ability to operate an information system to successfully utilize software; evaluate and use computers and related technology to support the instructional process; and explore, evaluate, and use computer/ technology-based materials, including applications, educational software, and associated documentation," to name a few (*Regional Collaborative Center for Professional Development and Technology Proposal,* 1992 p. 4B-6). The Commission on the Restructuring of the American High School pointed out that a high priority for the high school of the 21st century is electronic learning (National Association of Secondary School Principals, 1996). Consequently, as campus leader and role model to students and staff, principals need to be familiar with technology usage to apply it effectively. Thus, principals need to be provided the training and resources to become proficient in technology (Carter, 1997).

Collaboration of Schools & Colleges/Universities to Provide Technology Education

Public school and higher education officials need to collaborate in providing meaningful technology education programs to meet principals' needs (Kajs, Willman, & Alaniz, 1998). Ties with higher education are needed (National Association of Secondary School Principals, 1996), especially since professors of education believe in the values of lifelong learning for school educators (Lewis, 1997). Colleges and universities should look at establishing principal academies, which focus on the specific needs of principals, since they can serve as a viable vehicle for the ongoing professional development of school leaders (Behar-Horenstein, 1995).

In his study of principals' use of technology, i.e., e-mail, Carter (1997) found three predictors that determined usage—computer experience, training, and available resources. Consequently, professional programs in technology for school principals should be developed based on their knowledge base and job-related context of technology (McKenzie & Wurzburg, 1998). In developing an educational program for principals, a questionnaire or survey should be used to ascertain information about their technology interests and needs (Schmuck & Runkel, 1994). Ongoing feedback from principals during the professional development program can provide opportunities to adjust the program to ensure relevance of information (Nelson & Quick, 1997; Schmuck & Runkel, 1994). University faculty should develop a learning process that not only provides technology skills to be effective in job-related activities but also creates a "passion" for technology usage by setting up situations in which principals find solutions for self-selected school dilemmas (Eden, Eisenberg, Fischer, & Repenning, 1996). This passion can serve as motivation for continued, lifelong learning (Eden et al., 1996).

Research Study

To ascertain campus administrators' continuing education needs in technology, 100 elementary, middle school, and secondary principals from 23 school districts in Central, South, and East Texas were provided a questionnaire. The questionnaire asked them to indicate the types of technology education they wanted to meet lifelong learning goals. Fifty-one percent (51%) of the one hundred principals were from the elementary level, 29% held middle school campus positions, 18% were high school administrators, and two percent 2% were from campuses with both elementary and middle school grades. The questionnaire asked, "What technology education would you want to meet lifelong learning needs? Circle your preferences and/or add ones you would want." The preferences included six types of computer applications: (a) word processing, (b) presentation, (c) spreadsheet, (d) web site, (e) Internet and e-mail,

and (f) database. The questionnaire also asked principals to list other types of software application/technology they desired to learn.

The following results, in percentages, indicate the responses of the 100 principals to the six areas of continuing education: (a) word processing (46%), (b) presentation (63%), (c) spreadsheet (49%), (d) web site (37%), (e) Internet and e-mail (70%), and (f) database (59%). Six percent of the principals noted additional types of technology/software applications, including communications, digital camera, virus protection, scanners, project management, conflict matrix, decision-making, evaluation, curriculum, and distant learning.

Types of Software Available in Six Areas and Their Applications

Software products can be found in the six identified areas of computer application to assist principals in using technology for administrative and instructional tasks. Along with a short description of each of the six application areas, a few examples of software products are provided.

Word Processing

Word processing software is intended to provide easy production of text-based documents with ease-of-use features such as formatting and the manipulation of fonts and graphics. Modern word processing products have spell checking and thesaurus capabilities as well. Most word processors are able to export HTLM documents that can be read by web browsers. Typical uses of word processing include letters, memoranda, journal articles, announcements, notices, and flyers.

1. Corel WordPerfect Suite (Wordperfect) http://www.wordperfect.com/
2. Lotus SmartSuite (WordPro) http://www.lotus.com/
3. Microsoft Office (Microsoft Word) http://www.microsoft.com/word/
4. AppleWorks (Word processor) http://www.apple.com/appleworks/

Presentation

Presentation software is intended to ease the preparation for presentation to groups of people. The software allows standardized formats, backgrounds and colors, animations, and other visual effects to be rapidly produced. Not only can results be used on electronic projection equipment, but they can also be displayed on colored overhead transparencies and handouts. As with word processors, modern presentation software can export HTML files for web use. Typical uses of presentation software include in-service education or training, conference presentations, and information delivery to teachers, staff, parents, and community members.

1. Gold Disk (Astound) http://www.golddisk.com/
2. Lotus SmartSuite (Freelance) http://www.lotus.com/
3. Microsoft Office (Microsoft PowerPoint) http://www.microsoft.com/powerpoint/
4. Corel WordPerfect Suite (Presentations) http://www.wordperfect.com/

Spreadsheet

Spreadsheets are a form of electronic calculator. Data are arranged in rows and columns that may be manipulated arithmetically and statistically. Spreadsheets are used instead of databases when the primary content is numerical and calculations are frequent. Results are displayed in textual or tabular format as well as graphically using business charts. Most spreadsheets can export HTML for web use.

Typical uses of spreadsheets include budget preparation, analysis of standardized testing, and demonstrations of possible relationships between variables.

1. Corel WordPerfect Suite (Quattro Pro) http://www.corel.com/products/wordperfect/cqp8/index.htm
2. Lotus SmartSuite (Lotus 1-2-3) http://www.lotus.com/
3. Microsoft Office (Microsoft Excel) http://www.microsoft.com/excel/
4. SAS (Calc) http://www.sas.com/software/components/calc.html
5. AppleWorks (Spreadsheet) http://www.apple.com/appleworks/

Database

A large overlap exists between function and capability of spreadsheets and database technology. In general, databases are optimized to store and retrieve textual data, while spreadsheets are optimized to do calculations. Many database products can export HTML. Typical uses of databases include storage of student information and data, inventory data, and other textual information. It is common to combine the word processing and database to mail merge personalized letters to parents, teachers, or other groups.

1. Corel (Paradox) http://www.corel.com/products/wordperfect/paradox8/index.htm
2. Lotus SmartSuite (Approach) http://www.lotus.com/
3. Microsoft Office (Microsoft Access) http://www.microsoft.com/access/
4. AppleWorks (Database component) http://www.apple.com/appleworks/

Internet: Web Site Preparation and Browsers

Web browsers permit personal computer users to visualize data located in millions of other computers around the world. The structure usually begins with a home page with links to other pages. The web information is stored in Hypertext Markup Language (HTML), which can be produced by web editing software or in many cases other applications such as word processors. Web editors and other site preparation and management software work with the HTML. A school web site is typically used as a community bulletin board and a source of public relations information, as well as an opportunity to post special issues of interest to parents and to showcase student work.

1. Macromedia (DreamWeaver) http://www.macromedia.com/software/dreamweaver/ (preparation)
2. Microsoft Front Page http://www.microsoft.com/frontpage/ (preparation and site management)
3. Microsoft Internet Explorer http://www.microsoft.com/ie/ (browser)
4. Netscape Communicator http://www.netscape.com/download/ (preparation and browser)
5. Sausage Software (Hot Dog) http://www.sausage.com/ (preparation)
6. Adobe Software (PageMill) http://www.adobe.com/prodindex/pagemill.html (preparation and site maintenance)

E-Mail

Electronic mail is a means of asynchronous textual/graphic communications. It is an electronic analog of regular paper mail. The sender must know the electronic address of the recipient, just like one must know the address of the recipient to send a letter. E-mail can be sent to one person as well as to many individuals on a distribution list. Typically e-mail is used for quick informal communications, bulk distribution of notices, changes in standard schedules, and so forth. An advantage of e-mail is that the recipients can respond rapidly to the sender, so a quick on-line survey or poll could be easily implemented.

1. Lotus (cc:Mail) http://www.lotus.com/

2. Microsoft Outlook/Exchange http://www.microsoft.com/outlook/
3. Netscape Communicator http://www.netscape.com/download/ (e-mail)
4. QualComm (Eudora Pro) http://www.qual.comm.com/
5. Numerous self-contained e-mail systems like America On-Line (http://www.aol.com) and Juno (http://www.juno.com), Netscape, Yahoo, Hotmail, and many more.

Conclusion

Because of the campus leadership role and its accompanying responsibilities, school principals are required to be continual or lifelong learners. Public school administrators and higher education instructors need to collaborate to provide principals relevant technology education and training. In developing a continuing education program for school leaders, principals' instructional needs and computer experience must first be assessed, as well as principals' access to the necessary technology resources (Carter, 1997). During the continuing education sessions, informal formative assessments can provide useful feedback on the relevance of instruction to principals (Nelson & Quick, 1997; Schmuck & Runkel, 1994).

Questionnaire results reported in this article indicate that principals want technology education in all six areas, but especially in Internet and e-mail usage, and presentation and database applications. A variety of software applications are available for the administrative and instructional needs of campus leaders. A small percentage of principals also addressed other computer technology needs. Further exploration into school administrator needs should incorporate these technology/software elements. For instance, a category entitled "utility or special purpose software" incorporating campus planning (e.g., Project '98) and grade/portfolio management (e.g., Grady Profile) should be included. Other considerations in developing continuing education programs for principals would include the length and timing of sessions, as well as the creative handling of instructional sessions with participants who have varying computer experiences and instructional needs.

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Perception of Training Needs:
Principals' Use of Computer Technology in the School Environment

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Abstract

Virtually every sector of society is now influenced by technological innovations. In particular, technology embodied in the microcomputer and peripherals have dramatically altered the mechanics of how work is accomplished. Many professionals, doctors, accountants, scientists, and engineers have applied computer technology in accomplishing their work. Education, on the other hand, has not kept pace with these professions or society's other enterprises relative to integrating computer technology to achieve objectives (Picciano, 1998). Computer technology also has utility beyond classrooms. Specifically, it can assist principals to accomplish their managerial and administrative tasks. Using computer technology effectively and productively, however, requires an understanding and familiarization with the capabilities of hardware, and software programs. This study identifies the professional development needs of principals relative to their ability to use computer technology to accomplish tasks in their work. A professional development (training) needs questionnaire was developed and mailed to a selected group of rural Florida school principals. This paper presents these principals's perceptions of their professional development (training) relative to using computer technology in their work and facilitating its integration into schools.

Background

The advent, proliferation, and subsequent introduction of computer technology into schools occurred prior to principals and teachers preparation to effectively integrate it into their work. Even now, the versatility and complexity of function embodied in computers and related technology exceeds the level of expertise that principals and teachers have acquired to effectively use it for productivity purposes and to achievement curriculum outcomes and objectives. Professional development to use computer technology is an essential part of its integration into schools. Without training that focuses on *what* technology and how it can be made a part of the work and learning environment, computer technology will not be used to its potential. Not only that, but principals and teachers will also not be fully aware of the benefits that computer technology offers without professional development.

Because a significant number of principals and teachers did not experience computer technology during their preparation for a career in education becomes an impediment to its use in schools. Yet, computer technology is perceived as an important advantage and resource for education. And, the ability of school personnel to exploit its functions to improve aspects of schooling is expected. Appropriate use of computer technology cannot occur without sustained training opportunities for principals and teachers.

Since the decade of the1980's, school leaders and teachers have devoted a significant amount of attention, time, and effort to integrating computer technology into classrooms. In this thrust, the role of principals has been primarily one of planning for computer technology's integration, acquiring funds to obtain hardware and

software, and facilitating teachers professional development to use computer technology. In this pattern of events, an emphasis on principals acquiring computer technology skills and applying those skills to their managerial and administrative tasks has been deferred.

It is known that computer technology can influence principals' work productivity. However, principals have been somewhat overlooked in professional development opportunities to use computer technology because the emphasis has been on teachers and their integration of technology into practice. Principals, in the interest of the curriculum, teachers, and students remain preoccupied with issues of acquiring funds for computer technology in their school, providing access to computer technology for teachers and students, and facilitating teachers use of technology. The power and convenience that computer technology brings to the workplace cannot be ignored. At some point in time, it will become incumbent upon principals to divert their attention to familiarizing themselves with computer technology that assists them in accomplishing their work and then applying it on a consistent basis.

Purpose

The literature on principals and their use of computer technology to perform managerial and administrative tasks is limited. As well, there is minimal research that relates how principals can acquire skills to facilitate the integration of computer technology into the curriculum. By far, more is written regarding teachers and their integration of computer technology into the classroom. But even so, principals are expected to be leaders in this integration effort. Principals need computer technology skills to assists them to support teachers in restructuring schools through technology.

Principals can benefit from the capabilities embodied in computer technology. They, however, have not been subject to preliminary and ongoing professional development opportunities to acquire skills to use computer technology to accomplish their work or to facilitate teachers' integration of technology into the curriculum. The purposes of this study were to (a) identify the computer technology professional development needs of principals, (b) determine the extent of training principals have received in order to facilitate teachers integration of technology into their practice, (c) determine the extent to which principals have received professional development in understanding the role of computer technology in school reform, and (d) identify the kind of professional development principals perceive as important for them.

Principals and Computer Technology

Principals are a part of the educational milieu. In regards to computer technology, educators are still trying to determine how best to use technology to achieve objectives. This same difficulty is applicable to principals, that is, how best can technology be applied in the principals work environment? The answer to this question is to be found in answering another question. That question is what technology can be applied to principals' work? The identification of hardware and software programs that can positively impact the accomplishment of what principals do is a key to understanding how principals can use computer technology. This understanding can be derived by determining the specific kind of work principals accomplish.

The other part of the computer technology equation for principals relates to professional development (training). Once computer technology that can be applied to principals' work is identified, then professional development has to be made available for them to acquire the expertise to use it. But since school districts and schools mainly focus on professional development for teachers to use computer technology, when will principals receive the support they need to acquire computer technology skills?

In the computer technology integration effort, there appears to be a belief that principals know about computer technology and have a high level of proficiency in it. Trotter (1997) in contrast to this belief related a statement from a university professor who prepares school administrators. This professor stated that nationwide only five percent of school principals are well versed in using computer applications like word processing, spreadsheets, and presentation software. This tends to underscore a need for principals to be engaged in professional development that assists them to become knowledgeable of the capabilities and benefits of computer technology.

There is a premise that postulates that before computer technology can be effectively integrated into the teaching and learning process, that teachers first need to be familiar with and aware of its capabilities (Merrill, Hammons, Tolman, Christensen, Vincent, & Reynolds 1992; Simonson & Thompson 1997). This same premise can be applied to principals. Principals need to experience the capabilities of computer technology in order for them to use it in the work they routinely engage in. Minus a good understanding of computer technology's capabilities, principals will not be able to take advantage of those capabilities and apply it to their work.

Principals, in many ways are like teachers. Teachers have come to rely on traditional time-tested instructional methodologies to obtain results in the teaching and learning process. Principals too, have become comfortable over time with established ways of work. Reliance upon paper and pencil, secretaries, and other

clerical staff to create letters and other documents, and to prepare numerous reports have worked well. The change process is a difficult one to negotiate; especially if what's being used now is getting the job done. In some ways, the principal's use of computer technology requires a shift in the way work is conceptualized.

Learning to use computer technology effectively requires an understanding of the capabilities of programs and the extent of what electronic devices can do. As well, to use computer technology consistently for productivity requires a significant investment of time. This study sought to answer several questions related to principals' use of computer technology.

Study Participants

The participants in this study were elementary, middle, and high school principals who were selected from the 1998-1999 Florida Association of School Administrators Education Directory. Eight counties within the service area of Florida A&M University were selected from which to obtain the sample population. Selection of the principals was made through a random process. A total of 30 principals were mailed the questionnaire. Of this total, fourteen (47%) responded and returned the survey.

Questionnaire

To obtain a composite of principals computer technology professional development (training) needs, the researchers developed the Computer Technology Training Needs Questionnaire. The Computer Technology Training Needs Questionnaire was designed to obtain information to a variety of computer technology inquiries. Those primary inquiries were (a) have you participated in professional development (training) on selecting and evaluating hardware and software for use in the instruction of students, (b) have you participated in professional development (training) that assists you to understand the role of computer technology in educational reform and school restructuring, (c) have you participated in professional development (training) that demonstrated how principals can promote the integration of computer technology into the school curriculum, (d) how much professional development (training) to use computer technology has your school district provided to principals and , (f) what do you perceive as the most significant barriers to learning to use computer technology. Other information sought regarding principals and computer technology were (a) what computer applications are applicable to principals in their work, (b) what principals' managerial and administrative tasks lend to accomplishment using computer technology, (c) what professional development do principals believe they need in applying computer technology to accomplish work, and (d) what training do principals believe they need in order to assist teachers to integrate computer technology into the curriculum. The Questionnaire consisted of 16 items. Ten of the items were framed to be yes or no responses. Two items asked principals to rank their responses in order of importance and three items asked principals to check all that apply. And, one questionnaire item asked principals to indicate their level of expertise to use computer technology.

Findings

The purposes of this survey were to gather information relative to principals' professional development (training) to use computer technology. In this section, we report on the data from selected questionnaire items that demonstrate the state of principals' use and training to incorporate computer technology in their work, and to facilitate its integration into the school. Hence, the following discussion reveals what principals relate relative to themselves and computer technology. The statements below represent selected items that principals responded to. Those items are:

1. I have participated in professional development designed to assist principals to facilitate teacher's integration of computer technology into their practice.
2. I have participated in professional development (training) on selecting and evaluating hardware and software for use in the instruction of students.
3. Have you participated in professional development (training) that assists you to understand the role of computer technology in educational reform and school restructuring?
4. I have participated in professional development (training) that demonstrated how principals can promote the integration of computer technology into the school curriculum,
5. How much professional development (training) to use computer technology has your school district provided to principals?
6. What is the most significant barrier to my learning to use computer technology in my work?

Fifty percent of the principals responded to questionnaire item number one above in the affirmative. As well, fifty percent of the principals responded to item number one in the negative. For questionnaire item number two, as listed above, the results yielded 50% answering in the affirmative and 50% answering in the negative.

For questionnaire item three, as listed above, fifty seven percent of the principals responded in the negative. Questionnaire Item number, four as listed above, asked principals about professional development to promote integration of technology in the school curriculum. Seventy nine percent of the principals responded negative, meaning they had not received training to promote integration of computer technology into the school.

For questionnaire item number five, as listed above, principals were given the choices of none, a little, and a significant amount. Principals' responses to this item yielded seventy nine percent indicating that their school district had provided *little* professional development in computer technology for principals. For questionnaire item number six, as listed above, principals were asked to rank their responses in order of importance. Seventy nine percent of the principals responded by ranking *too busy with other demands of the job* as a significant barrier to their learning to use computer technology as the number one choice. This choice was followed by *not enough training to develop computer technology skills*.

Discussion of Findings

Principals are the leaders of a school. It is accepted that they are key individuals in the adoption and integration process of computer technology, and as role models (Cooley & Reitz, 1997) they act as catalysts for its use by teachers. Moreover, for the restructuring with technology process to be successful, principals will certainly have to play a significant role. That role, however, is best conducted with background and skill in using computer technology. Based on these findings, it appears that school principals are not being provided the professional development needed to use computer technology or to facilitate its integration into schools.

This study highlights the need for considerable emphasis to be placed on the professional development of principals to use computer technology. This not only applies to them in their need to use computer technology for their productivity, but also to facilitate teachers' integration of it into their practice. Without an understanding and familiarization with computer technology it is unlikely that principals will be the technology leaders required in schools today. If school districts fail to provide principals with training in computer technology how will they get it? Just like teachers, principals need professional development in computer technology.

One half of the principals in this study indicated that they have not received training that prepares them to facilitate teachers integration of computer technology into the curriculum. With the promise and anticipation of computer technology to affect student learning outcomes so great, how can it meet those expectations when school leaders to a significant degree do not possess the background and awareness of how to proceed to make it accomplish objectives? Certainly, this is an area that needs to be addressed if the promise of computer technology is to become a reality.

Fifty percent of principals in this survey revealed that they have not participated in training that provides them with an understanding of selecting hardware and software to be used in instruction. At the heart of the computer technology infusion effort is that it will make a difference in the teaching and learning environment. In fact, it is touted as being able to increase student achievement. Who is making decisions on what hardware and software to use in the instructional environment? As the instructional leader, principals certainly ought to be informed enough to provide some guidance if not lead the selection of hardware and software process. Again, principals not having professional development in this area is injurious to the computer technology infusion effort. Training in the selection of hardware and software is a must as the process to determine how best to use computer technology in schools continues to unfold.

Facilitating computer technology's integration in schools and defining roles for computer technology in schools are both important elements in the restructuring with technology process. Technology, particularly as it is embodied in microcomputers and peripherals are innovations that are new in education. It will take time to for school personnel to determine exactly how these innovations can best serve students and how they can be organized within the learning environment. To accomplish this will require understanding and vision on the part of school leaders. This vision will come with exposure to various kinds of technology and professional development designed to demonstrate the roles that technology can have in schools. Based on principals' responses, the professional development that demonstrates how technology assists in the reform and restructuring process is absent. In addition, training that informs principals of how to promote technology's integration is also missing. For school districts, it becomes an essential element to provide principals with the opportunities to learn how technology can be integrated to restructure schools and how to promote its integration. Both are important components in the process.

School districts focus in the technology infusion process has concentrated primarily on teachers. Principals have been neglected in the process. Yet, principals are important in the technology integration process and cannot be overlooked. Principals report little assistance from their districts regarding professional development to use computer technology. Again, if technology is to have the anticipated role and impact on student outcomes as envisioned by many, principals must be factored into professional development opportunities. It is reasonable to believe that with principals setting the example for technology in schools, that districts at some time in the future need to focus on what is happening in regard to technology with this important group.

Finally, principals indicated that they are too busy with other demands of the job such that it becomes a barrier to their learning to use computer technology. This no doubt is true; however, ways must be determine to provide principals with the professional development they need to use computer technology. Just as teachers have inservice days that are used to provide them with some skill, it may be that districts will need to set aside specific times wherein principals can learn about and learn to use computer technology.

Recommendations

There are several recommendations that they authors propose arising from this study. One, school districts need to focus more attention and professional development opportunities for principals to learn about and use computer technology. Professional development designed for principals to become familiar with various computer applications and how these can be applied to their work is essential. As well, training that emphasizes what principals can and should do to facilitate teachers integration of technology into their practice and the curriculum should be undertaken by school districts. Second, it as apparent that little emphasis has been placed on professional development that assists principals to understand the role of computer technology in educational reform and restructuring. There is an assumption that computer technology can enhance the learning environment and alter student learning outcomes. However, this is not likely to become a reality unless principals, who are the leaders have a clear vision of the role technology can have in the reform and restructuring process. An understanding of the capabilities, limitations, and benefits of computer technology must precede this vision of what technology can do. Therefore, school districts must begin to deliver professional development for principals that assists them to understand the role, capabilities and limitations of computer technology in the school setting.

Conclusion

The present study intended to determine the professional development needs of principals for them to use computer technology in their work and to facilitate its integration into schools. Evidence suggests that principals have training needs in computer technology that have not been addressed. A familiarization with and understanding of the capabilities, limitations, and benefits of computer technology are essential elements for principals to have as they use technology and promote its integration in schools. Without a doubt, principals can benefit from professional development to use computer technology. School districts and principals themselves must be concerned about the level of skill to use computer technology which also contributes to understanding how it can enhance personal productivity and the teaching and learning environment. If principals are to influence their professional productivity using computer technology they need to have training that assists them to do this. Also, if principals are to facilitate teachers' integration of computer technology in schools training also needs to be provided.

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Inhibitors to Computer Use in Schools: The Principals' Perspective

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Abstract: This paper reports the findings of a study that asked principals in Southeast Texas to rank order the inhibitors to the use of computer in schools. The key role principals' play in schools as well as the importance of technology as a key tool in building a learning community is discussed. The leadership responsibility of the principal to encourage the use of technology in learning is outlined. The highest ranked inhibitors to computer use in school were, lack of funds for hardware; poor infrastructure; lack of funds for software; and lack of time. Lowest ranked were, lack of a campus plan; take away from instructional time; general indifference; lack of skilled trainers and teacher resistance.

Introduction

There is a very definite demand from the public that our schools must be more current and appropriate for students as we begin to start the next millennium (Rose and Gallup, 1998). Educators are being told they are not keeping up with the real world. Business leaders are complaining that schools are not producing enough qualified workers. Researchers (Fullan, 1996; Goodlad, 1997; Sergiovanni, 1996) have begun to question whether we are meeting the varied educational needs of all students. There is a growing demand from the public to ensure that our schools are adequately preparing our students for the challenges that an increasingly growing technology demands. The role of the school principal requires leadership that will meet these demands. The key role principals play in schools is well documented and acknowledged (Buckner, 1997). Technology is a key tool in building a learning community within a school (Speck, 1999).

A survey of the literature in education points to the critical role of the principal as instructional leader in the school (LaRocque & Oberg, 1991; Henri & Hay, 1995). Pellicer, Anderson, Keefe, and McCleary, (1990) state that "...instructional leadership is likely the most important function in a school for creating a productive and satisfying environment" (p. 41). Daresh (1997) makes the observation that because of the emphasis on instructional leadership, preservice programs have focused on learning experiences that help future school administrators" ...oversee the teaching-learning activities in their schools as the primary area of attention and responsibility" (p. 5). Lou Gerstner, (1994) CEO of IBM, claims that nothing matters more to America's schools than finding competent principals to lead them. The perception of principals about what facilitates or inhibits their leadership role is critical to understanding the progress or lack of progress in the school.

Importance of Technology

Technology with the right software equipment and instructional design can enhance the student's active participation in his/her learning and encourage problem-solving skills by involving them in realistic assignments. This transformation from industrial-age schools into information-age schools won't happen without active leadership by the school principal. If schools are to take full advantage of the educational opportunities available through media centers, principals must be knowledgeable concerning their vast potential. One of these potentials was addressed in the Lance (1993) study, which revealed that quality school media centers significantly impact students' test scores.

Researchers at the Stanford Research Institute and Educational Development Corporation find that technology can be a powerful tool for supporting educational reform (1992). There is a plethora in the current literature about the need to reform our public schools (Sarason, 1997; Goodlad, 1997; Matthews, 1997; Wadsworth, 1997). As many States and communities across the country are learning, transforming industrial-age schools into information-age schools is easier said than done (Dyrli & Kinnamon, 1994). The key to ensuring the success of technology in schools is the way in which technology is integrated into the school's curriculum. As Kinnaman (1994) observes, successfully integrating technology into education requires basic changes to our current model of schooling; anything less sells short both the value of today's technology and the future of education. School principals must understand the importance of technology for improving school management as well as its implications for improved instruction. Technology holds great promise for personalizing learning opportunities (Drake & Roe, 1999).

Technology is the means to increasing learning efficiency. Technology can be used to better display information, increase access to information, improve information sharing, and organize better class presentations. Technology is not a panacea for educational problems, but by combining technology with applicable learning models, the overall quality of education is enhanced. Students raised in an age of technology demand student-centered learning. Educators must discover and develop how to implement new technologies into the learning environments and focus efforts on facilitating learning (Adams & Jansen, 1997).

Principals must accept the challenge to create supportive conditions, which would foster innovative uses of computers. As Dubrin (1998) points out, "The technology-minded leader should also invest heavily in training and establish a reward system for innovation (p. 355)". Principals must respond to the public demand for increased use of technology to prepare our students to meet the expectations of the society in which they will participate.

Resistance to Technology

It has been estimated that in 1995 the ratio of computers in schools to students was 1 to 9 -that is, on average schools had 1 computer for every 9 students (Loveless, 1996). Schools are still limited in their ability to take full advantage of computer technology because of cost, lack of teacher preparation, and inadequacy of the school's infrastructure. Even schools that were built fairly recently do not all have an adequate power supply, and few schools have telephone lines in every classroom (Loveless, 1996). A national survey conducted by the U.S. General Accounting Office (1995) found that in 46% of schools the electrical wiring would not handle the power requirements of computers. That finding helped explain why more than half (52%) of the schools surveyed did not have access to a computer network (Seyfarth, 1999).

Principals must be prepared to deal with teacher resistance to technology being integrated into the curriculum. Many teachers perceive technology as another burden of responsibility added to the already overwhelming load of a teacher (Hartzell, 1996). Principals have to be prepared to provide extensive teacher training in the integration of technology into the curriculum (Weiss, 1994). Principals need to create an environment

conducive to maximizing technology integration into the curriculum. A faculty that becomes comfortable with the ideas of technology will more easily integrate it into the curriculum.

Principals need to solve the dilemma of how to provide appropriate technology training for the entire faculty. Dyrli (1996) recommends a number of key elements for a successful staff development including: offering a variety of options, emphasizing skill development, providing hands-on experiences, tailoring programs to local realities, using genuine teaching examples and providing supporting materials. Principals need to be aware that if the teachers are not the focus of the technology training, then technology will fail (Guhlin, 1996). Teachers have to feel involved in the process of integrating technology into the curriculum. This involvement will ensure that the teachers take personal ownership for this responsibility. Once personal ownership has been established, it is easier for the teachers to work toward goals because they now have more purpose and meaning. The main thing to remember is whatever training the teachers have, it is crucial that it applies to them as professionals as well as individuals.

There are teachers and administrators who believe the lack of available money for technology is a problem when trying to integrate technology into the curriculum. It is important for principals to keep in mind that research shows that the amount of money available to a school district is not related to the innovative uses of computers. Exemplary teachers work in a representative range of communities and schools. However, they tend to be found in settings where school and district resources have been used to create supportive conditions (Becker, 1994).

Principals must accept the challenge to create supportive conditions that would foster innovative uses of computers. After one prepares the faculty in the professional development plan for integrating technology into the curriculum, one must give the faculty the access to the computers during instruction time and planning time.

Method

A survey was prepared based on the previous results of a study of principals in Southeast Texas (MacNeil & Delafield, 1998). This study showed a number of inhibitors that principals identified as being important for implementation of technology in the school. Because there was no measurement of the significance of these inhibitors a forced choice of 9 items was prepared for the principals survey. The survey was distributed by graduate students to principals in their districts. A total of 138 principals responded to the survey. The means, the first choice, as well as the three top choices were calculated and are shown in Table 1, (See Table 1), Table 2, (See Table 2), and Table 3, (See Table 3). The inhibitors that were rank ordered from 1 to 9 were as follows: Lack of time for training; Lack of funds to purchase or upgrade hardware; teacher resistance to use computers; lack of campus plan to integrate computers in the curriculum; poor infrastructure (i.e. wiring, etc.); feeling that computers take away from instructional time; general indifference to new technology; lack of funds to purchase software; lack of skilled trainers. The paper reports the results of the analysis of the data.

The results of the Survey

Table 1 shows the results of percent ranked within first 3 inhibitors principals identified as highest (See table 1). Table 2 shows the results for the first choice for the 9 items on the forced choice survey (See table 2). Table 3 shows the results for the mean scores for the 9 items on the forced choice survey (See table 3).

Inhibitors	% Ranked within Top 3
Lack of funds for hardware	63.2
Poor infrastructure	52.6
Lack of funds for software	49.6
Lack of time	47.1
Teacher resistance	27.6
Lack of skilled trainers	22.1
General indifference	18.7
Take away from instructional time	15.6
Lack of a campus plan	9.7

Table 1
Percent ranked within first 3 inhibitors principals identified as highest for the 9 items on the forced choice survey.

Inhibitors	% Ranked First
Lack of funds for hardware	36.0
Lack of time	22.1
Poor infrastructure	19.7
Teacher resistance	7.5
Lack of funds for software	5.9
Lack of skilled trainers	3.7
General indifference	3.0
Take away from instructional time	3.0
Lack of a campus plan	1.5

Table 2
First choice for the 9 items on the forced choice survey.

Inhibitors	Mean Rank
Lack of funds for hardware	3.24
Lack of time	3.64
Poor infrastructure	4.12
Lack of funds for software	4.16
Teacher resistance	5.40
Lack of skilled trainers	5.48
General indifference	5.99
Lack of a campus plan	6.23
Take away from instructional time	6.44

Table 3
Mean scores for the 9 items on the forced choice survey.

Conclusions

Public schools are not making good use of computer technology. They have been slow to adopt computer technology (Schlechty, 1997). Principals need help to lead their schools toward a more technology-enhanced environment. To do this they need more allocation of funds for hardware, infrastructure and software. They need to be given more time to both prepare themselves and their teachers to use computer technology to support the curriculum. The results of this survey indicates that principals are ready, willing and prepared to use computer technology as a tool to help educate their students. They need more resources and time to make it happen.

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Building Teacher Capacity for Authentic Learning in the Next Millennium

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Abstract: This paper describes a professional development model created by the Cleveland Heights-University Heights City School District to implement information technology to support fundamental change in teaching and learning. Our goal is to move toward technologically enhanced authentic instruction for all students. The Cleveland Heights-University Heights model has three guiding principles: 1) respect the individuality and expertise of teachers; 2) support teachers; 3) directly embed technology implementation into the district's systemic improvement efforts. The model uses a spiraling approach and is structured to identify and bring together teachers with common interests in order to co-develop customized professional development.

Introduction

The attempt to define an effective role for the application of informational technology in K-12 schools has intensified during the past decade as school districts invested heavily in resources to wire, equip, and connect their schools. Traditionally computers were typically located only in special laboratories. At the primary level laboratory usage focused on drill-and-practice of basic skills; at the secondary level most instruction took the form of computer literacy (Starr, 1996). None of the applications much affected the core curriculum or general educational experience. The dominant use of computers in classrooms was for instruction in computer literacy (Becker, 1994). Computers were seen to have limited impact (Cuban, 1995). Cuban further traced the introduction and attempted integration of radio, film, and television as examples of different technologies that were initially promoted as revolutionary and created great expectations, yet within two decades were relegated to limited use (p. 36). Barbara Means summarized the state of informational technology use stating that traditional uses of technology should not be constructed as bad practice but simply as activities that were not likely to transform learning (Means, 1995).

In March, 1997 the *Report To The President On The Use Of Technology To Strengthen K-12 Education In The United States* was submitted by the President's Committee of Advisors on Science and Technology, Panel on Educational Technology. The report stated that today's students must not only be prepared with facts or additional specific skills, "but with the capacity to readily *acquire* new knowledge, to solve new problems, and to employ creativity and critical thinking in the design of new approaches to existing problems." (p. 15) The Report suggested that the real promise of technology in education is its potential to help change the nature of teaching and learning when tied to instruction based on constructivist theory, rather than the traditional view of instruction as a process involving the transmission of facts from an active teacher to a passive student (p. 33).

The Cleveland Heights-University Heights City School District is a 7,200 student multi-cultural inner ring Cleveland suburb. In 1996 the district initiated a technology plan which articulated the position that informational technology would be used to support fundamental change in teaching and learning rather than automating traditional practice. Technology would be used to promote and reinforce authentic learning. Authentic tasks have real-world application, involving multiple disciplines, and are challenging to students (Means, 1995). We believe that informational technology, properly applied, can be a powerful catalyst to provide authentic instruction for all students regardless of race, gender, or social status. To meet this challenge we realized that providing technology would not produce desired results without an equal effort to develop and support an on-going, multi-tiered, professional development program that is targeted to integrate technology into constructivist pedagogy.

The Challenge

Since the 1983 report *A Nation at Risk* (National Commission on Excellence in Education) numerous reports have identified perceived shortcomings of our public schools' ability to produce students with the necessary skills and aptitudes to succeed in our information based economic environment. New approaches, higher standards and greater accountability were advocated. The literature appears to support technology enhanced constructivist learning environments as the preferred way to move away from the knowledge transmission model of learning toward an active learner model focusing on collaboration, communication and the knowledge construction process.(Edelson, Pea, Gomez, 1995). The need to target professional development asa major priority to accomplish true reform and restructuring has partially been addressed through the *Technology Innovation Challenge Fund Grants* and other similar federal and state initiatives.

We cannot, however, loose sight of our *teachers* as, the primary objects of professional development efforts. Teachers today have many requirements competing for their time. For example, the time commitment of meeting expanding IDEA requirements, state accountability standards, and social service issues must be balanced with data driven lesson preparation, instruction, assessment, and student management. We also must realize that teachers have lives away from school that also must be balanced with professional issues.

Our Model

The Cleveland Heights-University Heights Schools' professional development model is premised on the principle that teachers are doing a good job, have pride in their work, and are required to balance many competing interests during and after the school day. As a result, the model is structured to identify and bring together teachers with common interests, to co-develop customized programming for their needs. For example, during the 1997-98 school year the district began to implement the elementary component of its technology plan. Rather than equipping all classrooms with some technology, or a few buildings with an abundance of technology, we chose a spiraling approach tying implementation to professional development. Each of our eight elementary schools were equipped with one PS21 classroom (Public Schools for the 21st Century). Classrooms were equipped with six computers, including a presentation station, scanner, digital camera, software, and Internet access to take full advantage of project based learning opportunities. This first wave of teachers became our risk takers. There was much initial anxiety, yet they forged ahead. They controlled all aspects of their training. A district technology specialist was assigned as their facilitator. The group held regular formal and informal meeting, communicated almost daily via email, and became a true community of learners. The PS21 concept was expanded by twenty-four additional classrooms for the 98-99 school year spanning grades K-5. We now have 25% of our students learning in a technology enriched environment focusing on authentic learning.

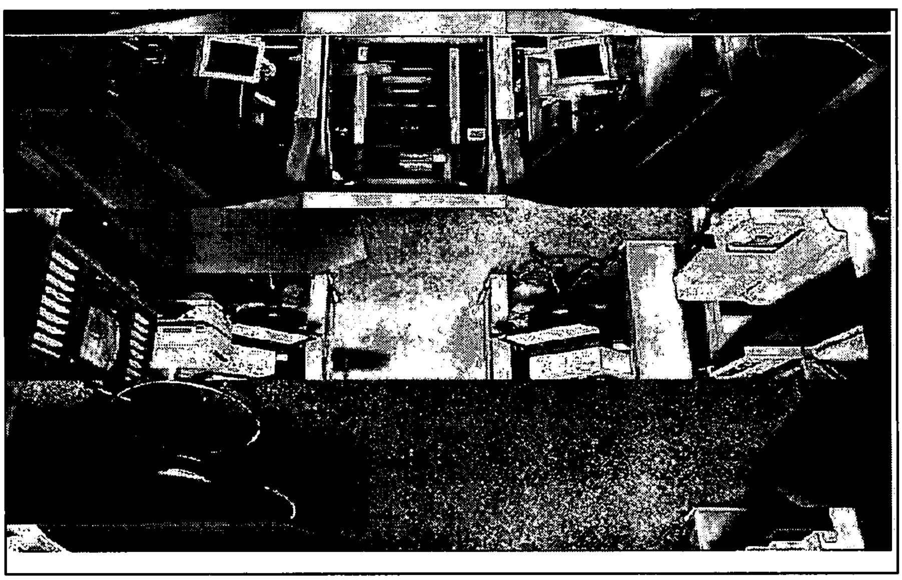
While our pioneer teachers were developing beyond initial expectations, supplemental opportunities were also made available for the rest of the staff through the establishment of Internet labs in each elementary school. These labs included up-to-date PC's, mounted projection devise, scanner etc. Half-time media specialists were increased to full time to staff the labs. After initial training, the media specialists worked with teachers to develop appropriate lessons and assisted the teachers while their class was in the lab. The labs and support personnel provided many teachers, who had no previous technology experience, resources without violating a person's boundaries and individual teacher's comfort level. Teachers were introduced to technology enhanced authentic learning when they were ready for it, not as the result of a predetermined schedule. The establishment of the Internet labs also served other objectives; they provide each building with a quality in-house training facility, and gave non PS21 students access to information technology resources. The media specialists became another cohort, similar to the PS21 teachers, who co-developed their professional development program with district personnel. They too chose to have their own WEB page, list serve, and other interactive communication links. The above examples demonstrate our first two guiding principles: 1) *respect the individuality and expertise of teachers*; and 2) *support teachers*. Although these principles are crucial process components, the third principle, *directly tie technology implementation to the district's systemic improvement efforts,* provides the vehicle to impact curriculum, instruction, and assessment.

The third principle is best reflected through the middle school technology plan's implementation which integrates 120 teachers attending evening and weekend technology skills workshops, job embedded training and support, and a 36 hr. intensive Critical Thinking Institute and follow-up attended by 40 middle school teachers. The Critical Thinking Institute is the key component in this design. The Institute is structured

as three, two day sessions, separated in time by a month between sessions for participants to apply their skills with students and report back. The first session is held two weeks before the start of school. Participants initially demonstrate commitment by their willingness to attend a summer session. Subsequent sessions are held during the school year with substitutes. By the end of the Institute, individual, or small groups of teachers have developed a unit of study focusing on creative and critical thinking skills. The units are compiled, reproduced and bound. Each participant leaves with a foundation of not one but 25 to 30 units developed by colleagues and directly applicable to their course of study. The units will also be posted on the district's intranet for additional distribution.

The Critical Thinking Institute is a parallel process to technology infusion. Within the next two years we anticipate that nearly all teachers from our three middle schools will have participated in the Critical Thinking Institute and its follow-up components. At the same time the district's wide area network will be in place, and each teacher will have appropriate technology in their classroom to apply their technical skills and pedagogy.

Roxboro Middle School Students and teachers will soon have a totally redesigned media center that integrates technology enhanced authentic learning center with traditional print materials. The Applied Learning Laboratory consists of over 3000 square feet of hands on stations, from a wind tunnel and weather station, to video production center. Students will be able to *Investigate*, *Produce* and *Perform*.



Picture 1: Roxboro Middle School media center publication center.

The timing of this spiraling model was set to coincide with Ohio's new graduation standards which stipulate that in 2003 every 10^{th} grade student will be expected to pass an exit examination which primarily requires problem solving, application, creative thinking, and critical thinking ability. The model is also being introduced at the high school. Eight members of the social studies department will shortly be working with Turner Learning, to pilot training materials and develop a video tape, for national distribution, with the CNN COLD WAR documentary series. This educational outreach plan was designed by Turner Original Productions and The Woodrow Wilson International Center for Scholars Cold War International History Project to provide teachers with a video library, multimedia archive, and two WEB sites (CNN Interactive site and the in-depth CWIHP site) for authentic instruction.

Next Steps

The next tier will be to introduce and embed Wehlage, Newmann, & Secada, (1996) *Standards for Authentic Pedagogy: Instruction*. The standards came from the five year School Restructuring Study (SRS): *Construction of Knowledge*, hypothesizing, or arriving at conclusions that produce new meaning and understandings; *Disciplined Inquiry*, explore connections and relationships and to produce relatively complex

understandings, and engage in extended exchanges to build improved and shared understanding; *Value Beyond School,* make connections between substantive knowledge and public problems or personal experiences (p. 33).

The district has established a professional development model which has demonstrated initial success in motivating teachers to participate in long-term training with the goal of changing teaching and learning structures. Given time, this model could transform the culture of a school district by using informational technology as a tool to eliminate classroom walls and professional isolation. Teachers are already inviting colleagues to building events and inservice through their listserve, or through the same medium asking questions that would only have been asked of a few teachers even a year ago. WEB sites with extensive links are being developed for and by these groups. The district has the ability and emerging capacity to become a true learning community.

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InTech 2000: Making Technology Happen

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This unique master trainer program, developed by the *Florida Technology Trainer Enhancement Center at the Miami Museum of Science* through funding provided by the Florida Department of Education and BellSouth, provides school leaders with the necessary tools to effectively implement, manage and assess technology integration at the school level. The latest component of the highly successful *InTech 2000* series, this program is specifically designed to meet the critical need for training school level administrators in supporting teachers efforts to incorporate technology into the curriculum at all instructional levels.

Session participants will be exposed to training materials from the program including Creating a Vision for how to use technology effectively in schools and the vital role played by school administrators and leaders in that process; Using the Internet Effectively as an Educational Tool; Basics of Computer Networking for School Administrators; Integrating Technology into the Classroom; Empowering Others Through Staff Development; and Tips for Success. Additionally, an overview of hands-on training in Navigating the Web, E-mail and the use of electronic presentations in school settings will be presented.

An *Administrator's Toolkit* of materials that support the Institute Training, as well as the *InTech2000 Hotlinks for School Administrator's* website designed for the specific needs of school administrators, located at http://intech2000.miamisci.org/adminlinks, compliment the Institute activities and provide on-going support for school administrators throughout the state of Florida.

For over a decade, TTEC at the Miami Museum of Science has developed and provided state-of-the-art technology inservice programs to thousands of teachers in 37 states. These professional development workshops simulate classroom instruction, working in groups and using technology as part of the curriculum. TTEC's unique training methods, using Learning Cards, allow for individualized, self-paced learning programs that incorporate the results of extensive research into the design and delivery of technology instruction.

Electronic Mapping in Education

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Abstract: In recent years the world of mapping and cartography has been revolutionized by the application of microcomputers applied to the tasks of data processing, data display, and map making. The potential use of electronic mapping in classroom is easy to recognize and becoming more common. Electronic mapping is a perfect complement to the student-centered, teaching model. The implications of the combination of inexpensive Geographic Information Systems (GIS) and multimedia development have the potential to significantly impact implementation and teaching the essential elements of geography and social studies. A rich potential for using GIS also exists in leadership and administration, at the district level as well as in the individual school.

Introduction

It is difficult to overestimate the impact of spatial information in modern lives. People mentally map their homes, their neighborhoods and their work or school environment. Cartographic maps are used to understand the physical world. At the macro level the cosmos and the stars are mapped. At the micro level, forms of mapping are used to describe the human genome of DNA and how to manufacturer microscopically small electronic components. Much day to day information is conceptualized in terms of space and time.

In recent years the world of mapping and cartography has been revolutionized by the application of microcomputers applied to the tasks of data processing, data display, and map making. Hardware and software for computer-assisted cartography and spatial data handling are widespread and cost-effective. Geographic Information Systems (GIS), designed to store, access, manipulate, and display spatial data, are continually finding new applications (Peterson, 1997).

Electronic mapping in the history, geography, social studies and even science classroom is becoming common. In a recent assessment of research in geographic education (Boehm & Peterson, 1997), different technologies, including GIS and CAD-like (Computer Aided Drafting) systems for visualizing geographic space have been proposed. Electronic mapping is a perfect complement to the student-centered, cognitive-constructivist (Hirumi, 1996) teaching model. The implications of the combination of inexpensive desktop GIS and multimedia development toolboxes have the potential to significantly impact implementation and teaching (Sanders, 1998).

At the present time it is uncommon to find electronic mapping being utilized within the administrative component of education. A rich potential exists in administration, at both the district and campus levels. Applications such as school bus routing, attendance zone boundary adjustment or systematically situating new school construction can be useful at the district. Analysis of student household demographic factors can provide information at both levels. Electronic mapping can be used to examine the safety and flow of sidewalks, streets and the transportation system, placement of safety patrol and crossing guards at the school level.

Why GIS?

In a white paper entitled GIS in K-12 Education (Environmental Systems Research Institute, March, 1998), a good case is made for classroom use of GIS technology. "GIS can be incorporated into current curricula in all grades and subjects, supporting and enhancing existing activities instead of requiring an isolated, dedicated place within the curricula. These powerful tools permit teachers and students to

explore and analyze information in new ways, focusing students' activities on the higher order thinking skills of observation and explorations—questioning, speculation, analysis, and evaluation." (p. 1). Of even more importance is the change in the educational paradigm, difficult for teachers who are accustomed to the teacher in the role of expert. The typical classroom style for using GIS is one of teacher/class teamwork and collaboration, making the transition more difficult for teachers who are accustomed to teaching in the role of expert.

Filson (1998) reports on teacher training programs in environmental science, which help students develop a "sense of place." Without a sense of place children and young adults cannot realistically see how their personal actions have relevance on a global scale.

GIS brings together into an integrated toolbox the hardware, software, and data to permit students to observe, explore, analyze and question spatial information. With easy-to-use graphical user interfaces, the student can develop and exercise higher order thinking skills. They can learn to think both independently and critically, taking advantage of information from others, yet testing the ideas and casting them in new configurations. They can develop skills of thinking, questioning, finding information, expressing ideas, listening to others and valuing their contributions, and developing a disposition to learn (Environmental Systems Research Institute, March, 1998).

Using GIS tools is useful in implementing state standards (Sanders, 1999), national standards (National Geographic Research & Exploration, 1994 and National Council for the Social Studies, 1994), as well as enhancing the status and quality of geography teaching and learning (National Council for Geographic Education, 1998). The national geography standards comprise three components (i.e., knowledge, skills, and perspectives) across the six essential elements. Of especial interest are the skills of asking geographic questions, acquiring geographic information, organizing geographic information, analyzing geographic information, and answering geographic questions (National Geographic Research & Exploration, 1994).

Capabilities of GIS

Typically a GIS system is an integration of components designed to create, store, retrieve, manipulate, and display various types of geographic information. The basic components include hardware (computer, printer/plotters, and digitizers), software (operating system and GIS software), data (created, bought, or downloaded), and people (including teachers and students). Sometimes a plan is included in the component list.

Functional capabilities of GIS systems usually include (1) creating and editing of information (including digitizing, event mapping, address matching and geocoding, joining or merging tables); (2) analysis of information (including tabular queries and spatial queries); and (3) display of information (including thematic mapping, creating charts and graphs, map composing, and hot-linking). See ESRI Canada Limited (1998) for additional insight.

The windowing and mouse-click interface capabilities of the modern desktop system provide a user-friendly graphical user interface to support the powerful software capabilities. Different windows provide for the display of maps, the tools to manipulate the data, the display of tabular data, and even the creation of pie and bar charts based on the available data. Even at the elementary school level, with appropriate guidance and instruction, computer literate learners can master the skills required to make use of the system.

How GIS Helps Learners

In a four-page brochure entitled "Exploring Common Ground: The Educational Promise of GIS" (Environmental Systems Research Institute, 1995) eight broad requirements, possibilities, and implications are discussed in depth. The topic headings are as follows: (1) GIS can play a role in educational reform; (2) GIS is a vocational tool; (3) GIS engages and exercises multiple capacities and intelligences; (4) GIS relies on and fosters a mindset of exploration; (5) GIS relies on and promotes finding information and appropriately using it; (6) GIS relies on and promotes spatial awareness; (7) GIS relies on and promotes

computer literacy; and (8) Using GIS effectively requires knowing how to make the GIS software perform particular tasks. In sum, GIS can be a powerful tool in the efforts to enhance education. Students and teachers can work together to build a coherent framework for information about the world. The community can share in the process of providing educational experiences and can gain from intelligence provided by the students. The focus on collaboration among students, teachers, school, and community can provide significant long-term benefit for all.

McWilliams and Rooney (1997) in their "Mapping Our City" project had nine key findings regarding the use of GIS. One, maps help focus student attention on spatial aspects of data. Two, GIS helps students discover relationships among spatial variables. Three, GIS assists students to organize and store their data. Four, GIS technology can encourage open-ended exploration of data if GIS technology is made. Five, GIS technology helps students manage complexity. Six, third-party data makes student efforts more useful and interesting when using GIS. Seven, student engagement with GIS technology increases with the use of multimedia. Eight, students do not mind the extra time needed for data creation with GIS. Lastly, GIS technology helps sensitize students to issues of data quality.

Concepts such as location, scale, resolution, and ecological correlation are more easily taught using GIS (DeCola and Haimus, 1995). At the elementary school level, GIS can be used to introduce students to maps and to spatial concepts, as well as explore significant features of geography. At the middle school, students study regions and relationships across space, and begin cross-discipline studies. High school GIS expands the study of regions and characteristics, and develops market research applications, test theories of geographic patterns and urban planning (ESRI Canada Limited, 1997).

Examples of GIS in the Classroom

One well-funded and successful example is “Mapping Our City” (McWilliams and Rooney, 1997 and TERC, 1998). This project involves GIS in learning science and geography. With assistance from TERC (a nonprofit research and development organization committed to improving mathematics and science learning and teaching), middle school students and teachers in Boston schools are using GIS to explore their urban communities. Students observe and study both natural and human environments—the geology of the area, plants and animals, local transportation systems, the changing shape and uses of Boston Harbor, to name a few examples. Collecting their own data as well as using satellite images, aerial photos, and other visual tools provided by the project, the students can display, modify and analyze these data on computerized maps. This combination of real-world investigations and interactive visualizations can help students grasp the inter-relationships of natural and human elements in their environment and develop key concepts and inquiry skills.

The work of Donna Wendt, a GIS analyst with the City of Tacoma, Washington, is a good example of collaboration between community and schools. She works with teachers on a South America geography project, a traditional large research report for sixth grade students. In the past, the students have presented an extensive written report at a parent-attended event. This presentation would include the types of the food, music, and other aspects of a chosen country. However, now with the use of GIS, thematic mapping of specific student prepared spreadsheet data, hot links to images, music and text about the country will be added. These students have also used GIS to analyze voting patterns for a failed bond election (Wendt, 1998).

Articles from various publications (Environmental Systems Research Institute, 1998) provide a variety of examples: (1) a middle school in Minnesota uses field work, lab work, and GIS to study the expansion of timber wolves; (2) Blue Valley School District in Overland Park, Kansas explores school district population changes; ((3) high school students in Massachusetts learn GIS and help their community do hazardous material emergency planning; (4) Seaside High School developed a Coastal Studies and Technology Center to get students interested in the environment; and (5) Joseph Cook Elementary School in Syracuse, Utah used GIS to update the state of Utah's Antelope Island database to alert state legislators on how a proposed road-building project could affect natural and historical points of interest.

Other ideas include using GIS as a hardcopy cartography station for teachers creating student materials, creating cartographic clipart for use by students in producing multimedia portfolios using PowerPoint (Microsoft) or HyperStudio (Robert Wagner), creating a limited version GIS exploratorium for use in school library or other public location (Environmental Systems Research Institute, 1997).

GIS in Education Administration

Teachers and students are not the only potential users of GIS. Administrators at the district level as well as at the individual school have the ability to utilize the analytic and "what-if" capabilities of GIS. The complex problem of bus routing is one such application (El Shafey, 1997). Redistricting (Caliper Corporation, 1998), analysis of attendance zone boundaries, residential development analysis for future school site selection, and even the process of finding the best available land can be accomplished using GIS as a tool. Many consultants, like Davis Demographics & Planning, Inc. (1998) use GIS as the basis for their services in demographic, facility and master planning. Some consultants, like Davis Demographics, also sell software extensions to support this process. Even simple tasks, like creating geographically specific mailing lists and surveys are easily accomplished using GIS.

Issues

The 3T's can summarize the issues in satisfactory use of GIS in education: time, training, treasure. Time means time to implement, time to train, time for the curriculum to mature. Training is required for teachers, students, and technical support personnel. Teachers and classroom equipment need "behind-the-scenes" technical support in order to use GIS effectively (McWilliams and Rooney, 1997 and Environmental Systems Research Institute, 1997). Treasure includes the cost of all necessary resources, including hardware, software, data, training, and support. The potential for GIS is great. Sometimes the participants, whether administrators, teachers, parents, or students, may expect too much.

These are some typical barriers: (1) insufficient hardware available at the school; (2) insufficient access in the classroom to existing hardware; ((3) lack of GIS software for use on available computers; (4) lack of usable data about the desired focus topic; (5) insufficient GIS skills on the part of teachers; (6) extensive training to learn GIS; (7) lack of a specific, relevant curriculum engaging GIS; (8) insufficient time to engage open explorations with only vaguely defined goals or highly variable results; (9) lack of pedagogical style conducive to GIS, especially as an exploratory tool (Environmental Systems Research Institute, 1998).

Conclusions

Electronic mapping can be easily incorporated into current classroom curriculums at all grade levels and subjects. It can serve as a pedagogical tool to support and enhance the curriculum. This powerful tool permits teachers and students to explore and analyze information in new ways, focusing students' activities on the higher order thinking skills of observation and exploration, questioning, speculation, analysis and evaluation (ESRI Canada Limited, 1998). Students become actively engaged in the process of data creation and analysis. They learn to live and work effectively with technology that will be an integral part of their future. Moreover, with properly trained personnel, school district and campus administrators can use GIS software to create and maintain a comprehensive facility planning and demographic information system to allow a wide range of planning and analysis.

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What Decision-Makers Should Know
About Web Based Delivery of Distance Education

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ABSTRACT: The current American education system is faced with shifting market patterns resulting from rapid changes in the technologies designed to enhance the delivery of educational services. Technology's influence cannot be denied as it is changing the way we teach, conduct research, and seek to provide increased educational opportunities without increased budgets. In answering this challenge many decision-makers are rushing to develop online distance education programs often without a proper understanding of the factors involved.

This paper provides background into the World Wide Web's Virtual Classroom, discusses some of the key elements and players associated with the development of online courses, and shares some observations of the authors' experiences teaching online courses. These observations represent practical advice or suggestions for those new to this domain and who wish to learn how to make the implementation of online courses a more meaningful, worthwhile, and painless process.

1. THE VIRTUAL CLASSROOM AND ITS EFFECTIVENESS

One of the most dramatic trends in higher education, as well as in the K-12 and training realms, is the emergence of courses, and in some cases entire degree programs, which are not delivered in the traditional teaching/classroom environment. Rather they are presented through the medium referred to as the Internet or the WWW (World Wide Web).

This newest method of college-level instruction has been called "the cyber league," "the electronic university," or "the virtual classroom" [Hiltz, 1995]. These terms refer to a particular type of distance education in which the teaching/learning takes place via a computer network. The network can consist of a Local Area Network (LAN), an intranet within an organization, or it can be web-based and hosted on the Internet. This type of distance education is gaining tremendous momentum as institutions seek to provide for a more diverse student population.

Decision-makers first need to develop an understanding of what constitutes the WWW and a VC (Virtual Classroom). The WWW or Internet is the world's largest, most powerful computer network connecting high-speed supercomputers, sophisticated mainframes, and personal computers around the globe. Millions of computers currently make up this network and the number grows daily. Web browsers allow the integration of text, graphics, and sound into a single tool which makes it easier for the novice user to enter this exciting learning environment.

For educators, the WWW provides an opportunity for distance teaching and learning utilizing a classroom homepage with course information including the syllabus, exercises, examinations, and links to other sites around the world. Many of these links can be to sites that provide historic background or current information relevant to the subject being studied. Other links can access library catalogs, or the homepages of service and support agencies. Instructors will also find it convenient to use homepages to create forms such as roll call, surveys, examinations, and course evaluations for students to fill out and submit as part of the VC routine.

There is, of course, a very real difference between the VC and a traditional classroom in that its walls are not made of bricks and mortar. Rather the VC contains "classrooms" that are constructed from computer software and provide meeting places where an instructor and students communicate, interact with

each other, and participate in the learning experience. The interaction with the material or content of a course, and the "interpersonal" interaction of participants, has been established as the two types of interaction required for learning to take place. Today's technology creates an environment "rich in various opportunities for interaction" [Berge, 1996].

Participation in most VC's is generally *asynchronous* meaning that all participants do not have to be online and "meet" at a pre-determined time. Students may login and read, post questions, complete assignments, and respond to other students' postings at any time and from any location with convenient access to the Internet. Because of this asynchronous communication, online learning is well suited to "working adults who want to increase their capabilities and opportunities in the workplace" [Bedore, et. al, 1997].

The demands of work and family make the VC attractive for busy people, as it is available 24 hours a day, seven days a week. Not only does this make learning convenient; it allows students the advantage of more time for reflective and critical thinking before submitting a reply to an assignment. Additionally, the VC provides an opportunity for those who may have difficulty attending traditional classes or may be reluctant to do so. Online education is relatively free of many of the biases and distractions associated with the traditional classroom environment [Kearsley, 1997]. The physical appearance, speech and language distinctions, or other disabilities remain largely invisible.

There is the question of whether the distant education student learns at the same level as students in the traditional "on-ground" classroom. Research comparing distance education to traditional face-to-face instruction indicates that teaching and learning at a distance can be as effective as that achieved with traditional instruction [Moore & Thompson, 1990; Verduin & Clark, 1991]. This is based on the assumption that the method and technologies used are appropriate to the instructional tasks, there is interaction between participants, and there is timely instructor-to-student feedback.

2. THE KEY PLAYERS

There is no magic formula for the development of an effective distance education program. There must be careful planning and a focused understanding of student needs and course requirements. While technology plays an important role in the delivery of distance education, educators must remain focused on instructional outcomes, not the technology of delivery. The key to an effective distance education program is to focus on the needs of the learners, the requirements of the content, and the constraints faced by the teacher, before selecting a delivery system. Once these elements are understood, the appropriate technologies can then be selected. For an online distance education program to be successful there must be dedicated, hard working individuals and organizations, including students, faculty/facilitators, support staff, and administrators – the key players.

Students are naturally one of the key players, whose primary role is to learn. Meeting the instructional needs of students is usually the cornerstone of most institutional mission statements. It requires planning, motivation, and the ability to analyze and apply the instructional content being presented. It is a difficult task to master even under the best of circumstances in a traditional learning situation. The task becomes an even greater challenge when presented in a virtual classroom environment.

The successful development of any distance education program rests squarely on the shoulders of the institution's faculty. With this thought in mind, decision-makers must seek to encourage and assist those individuals who are willing to take the time and risks necessary in building effective programs. In the traditional classroom, an instructor's usual responsibilities include assembling course content and developing an understanding of student needs. The online distance education instructor faces some special challenges. For example, an online instructor must:

- Develop an understanding of the characteristics and needs of their online students, with limited face-to-face contact.
- Adapt their teaching styles for a very diverse audience with multiple needs and expectations.
- Remain focused on educational goals while developing a working knowledge of the technology used for delivery.

Another important element decision-makers must understand is that for an online distance education program to be successful *there must be a team*. The team should include instructors/facilitators, support staff, and administrative staff. Care must be taken not to allow budget restrictions to dictate the make-up of the development team. While the instructor/facilitator is probably the key to the success of any online program, there are other members of the team with equal importance. Decision-makers should not assume that the instructor/facilitator would be able to effectively handle all the responsibilities of developing an online course.

Many early models allowed, even embraced this idea, and there were instructors who believed they could handle all the responsibilities. It was tempting for administrators to "engage" these "special individuals" in an effort to keep costs in line. All too often these online technology pioneers quickly became over burdened, began to function ineffectively, and the online program failed. If possible, a separate facilitator should act as the instructor's eyes and ears, bridging the gap between students and the instructor. Support staff can assist with the myriad details of a program, such as registration, materials duplication and distribution, textbook ordering, scheduling, grade reporting, etc.

The final key player in an online program is the administrator. The administrators are the decision-makers, the consensus builders, and often must act as referees. They must seek to maintain an academic focus while working with technical and support personnel to ensure the effective deployment of the technology resources necessary in meeting the institution's mission. Typically, administrators are the guiding influence behind an institution's distance education program. While allowing staffs to function freely, they should strive to maintain contact and a degree of control necessary to ensure the continued success of established programs, and encourage the research required for the development of new ones.

3. OBSERVATIONS

Our university currently offers over fifteen online courses. Others are being developed and plans are underway for the development of complete online associate degrees in CIS (Computer Information Systems) and BUAD (Business Administration). Two of our successful online courses are "Understanding and Using the Internet" an undergraduate course for beginners and "Integrating Technology into the Teaching/Learning Process" a graduate course in our Educational Technology Masters program. Here are a few observations concerning the impact of the online paradigm based on our own experience.

1. Development and implementation of an online course initially requires a great deal of time and effort, much more than for the traditionally taught course. We found that substantially more lead-time is required in preparing for the presentation of an online course.
2. Existing course materials should not be used solely because they are readily available or because they have worked in a traditional classroom environment [Beare, 1989]. They must be reviewed and changes made to ensure they are relevant to the techniques used for online courses.
3. Once the basic course materials have been developed, the delivery techniques are at an acceptable level, and the class size is manageable (25 or less), the actual work to conduct the class is about the same as for a traditional class. We found that the workload is directly proportional to the number of students in the class and efforts must be made to limit the size of class sections, and the grouping of sections should be avoided.
4. An orientation session covering the fundamentals of the delivery system and the course being presented is extremely valuable. This orientation should be offered at a time that will allow "on-ground" participation and to the extent possible, be available for later "online" participation for those unable to attend.
5. Additional time must be built into the startup of a class to allow the instructor time for "rounding-up" those students who are "lost in cyber space" and need assistance getting started.
6. We found that the instructor/facilitator spends a great deal of time working with students individually. Students expect immediate answers to their electronic questions. A suggestion here is to establish online office hours with "live chat" if possible.

7. We also found that the instructor/facilitator must allow time "for learning to take place". That is, provide adequate time for new users to become comfortable with the technology being used and become familiar with the ins and outs of the online process. Be sure to build some "flexibility" into any deadlines.
8. It is critical that the system functions properly and is accessible. Technical difficulties will occur occasionally and when they happen the focus should be on solving the problems not placing blame. Problems encountered must receive immediate attention and students must not feel that they have been abandoned. A suggestion is, if possible, establish a toll free "hotline" where assistance is readily available.
9. Evaluate-evaluate-evaluate. One purpose of evaluation is to determine if the instructional methods and materials will accomplish the established goals and objectives. Implementation of instruction is the first real test of what has been developed. It is imperative to conduct a "field test" on a small scale to determine the effectiveness of an online program and to work out as many unforeseen problems as possible. Even then, the first attempt at full implementation should be as a "pilot" in an effort to ensure that the experience is a success before full-scale implementation occurs.
10. Revise-revise-revise. Even the most carefully developed distance delivery course will have room for improvement, and the need for revision must be anticipated. Revision plans are typically a direct result of the evaluation process. Evaluation and feedback from content specialists, colleagues, and students are critical elements in the revision process. Often, the best source of revision ideas comes from the instructor's own reflection on the weaknesses and strengths of the course.

4. SUMMARY

In this paper, we have provided background and insight into the World Wide Web's Virtual Classroom and the effectiveness of online distance education, discussed some of the key elements and players associated with the development of online courses, and shared, through our observations, some practical advice and suggestions. It is hoped that those new to this domain have gained additional knowledge and a greater insight into this ever changing method of instruction. And, as you move toward new or continued development of online distance education you will do so in a more meaningful, worthwhile, and painless process.

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Leadership Concerns Toward Implementation Of The Texas Essential Knowledge And Skills (TEKS) For Technology Applications

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Educators have long exhibited concerns over changes in the curriculum. The political benefits of having the latest in educational technology are nothing new, reinforcing educators' cynicism about adopting innovations. New curricular standards for Texas have recently been adopted, requiring new hardware.

The Concerns-Based Adoption Model (CBAM) ascertains the concerns of educators as they implement innovations, a portion of which is the Change Facilitator Stages of Concern (CFSoC) survey with statements reflective of school leaders. This present research seeks to determine the concerns of change facilitators as they implement new curricula for technology applications.

Our study context is a six-school educatioanl technology consortium. We will be interviewing superintendents, principals, and technology "experts." There will also be a confirming survey (CFSoC). We will review documents on technology implementation, including board minutes, policy statements, evaluations, grant applications, and archival records.

The study design is exploratory, avoiding assumptions over our informants' concerns and personal biases on our data analysis. Through the analysis method of pattern-matching, we will compare those concern patterns we find with established concern patterns of change facilitators.

Effective Approaches to Initiate Technology Planning For Schools: A Classroom Model

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ABSTRACT: Technology is advancing rapidly. Increasingly it is becoming an integral part of the school curriculum. Over the past decade, school districts have spent billions of dollars on classroom technology, yet the classroom has changed little. Many factors have been attributed to the problem. However, a primary one is the lack of effective technology planning at the campus and district level. This paper describes how students in a graduate Educational Technology class are discovering some answers and taking them back to their schools or school districts. Technology planning can provide assistance and guidance for these teachers wishing to incorporate technology into their schools.

Technology is advancing rapidly. Increasingly it is becoming an integral part of the school curriculum. However, technology for technology's sake in education is an expensive and generally futile endeavor (Picciano, 1998). Over the past decade, school districts have spent billions of dollars on classroom technology (Golden, 1997), yet the classroom has changed little. What was the reason? Many factors have been attributed to the problem. However, a primary one is the lack of effective technology. Picciano (1998) states that the major impediment to establishing successful computer-based applications in schools now is the lack of careful planning.

The planning process for schools and school districts is a major factor. Many districts are trying to construct a long-range technology plan that will provide a direction for the future and, at the same time, meet the requirements of state and/or federal legislation (Golden, 1997). Who is supposed to take the major initiative for technology planning in the school or school district? How do they get the planning process started effectively? What do these educators need to know about technology planning and its process? This paper describes how students in a graduate Educational Technology class are discovering some answers and then taking these back to their schools or school districts. Technology planning can provide assistance and guidance for these teachers wishing to incorporate technology into their schools.

Real Life Situations in Some Schools Today

Technology has had a tremendously staggering impact on education. The repercussion of this technology explosion has caused school districts to implement technology in various ways into the curriculum. Successful technology programs demand constant attention, organization, and efficiency. Unfortunately, many school districts are lacking in these components of productive technology. The principal reason for the less

effective use of technology in classrooms is that the process of bringing technology into instruction has not been effective and in fact has been described as inefficient and poorly planned (Picciano, 1998).

The smooth operation of any technology program is dependent on a variety of factors, one of which relates to personnel. Instructional activities that incorporate technology can quickly be interrupted when printers are not working properly, or the network is malfunctioning. These are problems that need immediate attention; however there is not much a technology coordinator can do if he/she is in the middle of teaching a class—as is often the case in many districts.

Frustration can occur when the technology coordinator is given money by the school board to upgrade eight library computers to Windows '95 over the summer, but does not have time to work on them because the classroom computers have precedence over the library computers due to the school's computerized grade book. In a recent occurrence, for the first three months of school students were unable to use the new computers because they were not connected to the network. After three months of waiting, the library computers were finally hooked to the network, only to discover that there was not enough memory left to perform simple tasks such as downloading articles from the electronic magazine database or installing educational software. As a result, these computers are now gathering dust while information-seeking students are limited to the print resources in the library. It is unfortunate that the money and time spent in the upgrade could not have been better utilized by purchasing several new computers for the library.

A major consideration is the layout of the facility—a task that requires careful planning. A difficult situation may arise, as in one school district where the library media center was built adjacent to the basketball gymnasium. The acoustics were problematic, particularly when students needed a quiet place to concentrate. In that district, perhaps it is time for a redesign of the library, with a move to a new location.

Another baffling situation has taken place in a library that needs a computer with CD ROM capabilities to provide students with access to research materials. The administration has acknowledged the need, but has not steps taken to fulfill that need. Meanwhile the educational CD ROM software in the library cannot be used.

Internet-access is becoming available in many districts—with multiple grants available to help districts that are not yet online. There is growing awareness that lack of Internet access results in teachers and students being denied hundreds of educational resources. However, among the schools that do not have the Internet, some have no interest, while others do not have the time and/or human resources needed to plan, implement, and maintain the needed network connectivity. Management of the system, as well as the numerous technology components, is a very important factor in a successful technology program. Users expect a fault-free, friendly system. When users are denied this, they can quickly lose faith and may give up on technology.

In each of the above instances, a technology plan would have provided a basis for overcoming problems, or preventing them before they started. Planning for technology in today's schools is essential.

Necessity of Technology Planning in Schools

The real life technology situations in schools reveal that in many schools, teachers and students have not been able to use technology in the classroom as they should. This includes both hardware (individual computers and computer networks) and software, and definitely limits instructional opportunities. One of the major reasons for this, as Golden (1997) pointed out, is the lack of vision and leadership, namely, of good technology planning. Research conducted by the National Center for Technology Planning (NCTP) revealed that fewer than 30 percent of America's schools possess a written technology plan that is integrated into the curriculum (Anderson & Perry, 1996). Many schools put together an itemized list of what computers and software that need to be purchased, which room these computers should be put in, and how they will be networked—and they call this their technology plan. A shopping list is not a plan (Golden, 1997)! To utilize the full power of technology, careful technology planning, which shows the vision and leadership of how to organize and use the technology in learning, is a must.

Successful management begins with the technology plan. A well managed, efficient, organized program begins with a thorough examination of the existing technology facility and equipment. A needs assessment must be completed before planning can take place. The person in charge of the planning should form a committee that will represent the administration, school board, faculty, and the community. Giving these members ownership in the plan will make an enormous difference. Allocating responsibilities will take some of the workload off the technology coordinator, and it will help others to stay involved. Allowing others

to have opportunities to give input into the plan will help to build positive public relations. The entire planning process demands a collaborative effort. This will ensure that the school district is making every effort possible to create a community of technologically literate life-long learners.

The purpose for planning is to provide for leadership and direction. The written document should give specific guidelines and checkpoints to follow. The plan itself defines a mission. The goals that are set tell what will be accomplished, and the objectives explain how these goals will be achieved. A time line sets limits, and it helps district personnel understand what is involved in each phase. Ongoing assessment is essential, to assist with both planning and implementation. Knowledge about and ownership of the technology plan by all persons in the districts will greatly increase instructional uses of technology in support of learning.

Classroom Approaches

How, then, do teachers learn about technology planning? Do they know if their districts have plans, and what are in them? What might they do if there is no plan, or an outdated (inadequate) one in place? The following is a description of how one university is addressing these questions through a course designed to prepare teachers to look for, understand, update, and, if needed, become part of a team to prepare a technology plan.

The classroom approach is generally divided into three steps. First, students' awareness is raised of the existing technology status and situations in schools today, especially in the schools or school districts where they work and/or live. After discussing techniques related to collection of data on technology facilities, computer equipment (both hardware and software), media equipment, current budget, staff, and related issues, students were assigned the task of collecting and analyzing data about the existing technology status and situations in their schools and/or school districts. As they brought their reports to class and shared these, emphasis was given to understanding of the importance of data collection and analysis in the process of technology planning, since data collected are likely to be used in different parts of the planning document.

Second, after identifying their school's needs, students were asked to "dream" of what they would like their technology facilities to be in the future, based upon the current technology status, as well as the needs they had described. Technology management techniques and skills were then taught to help students learn how to transform their "dreams" into blue prints for technology for their schools. Media technology, technology lab management, and networking technology and network management techniques and skills were all included, as students laid out their floor plans in drawings and narratives, including specifications in these areas.

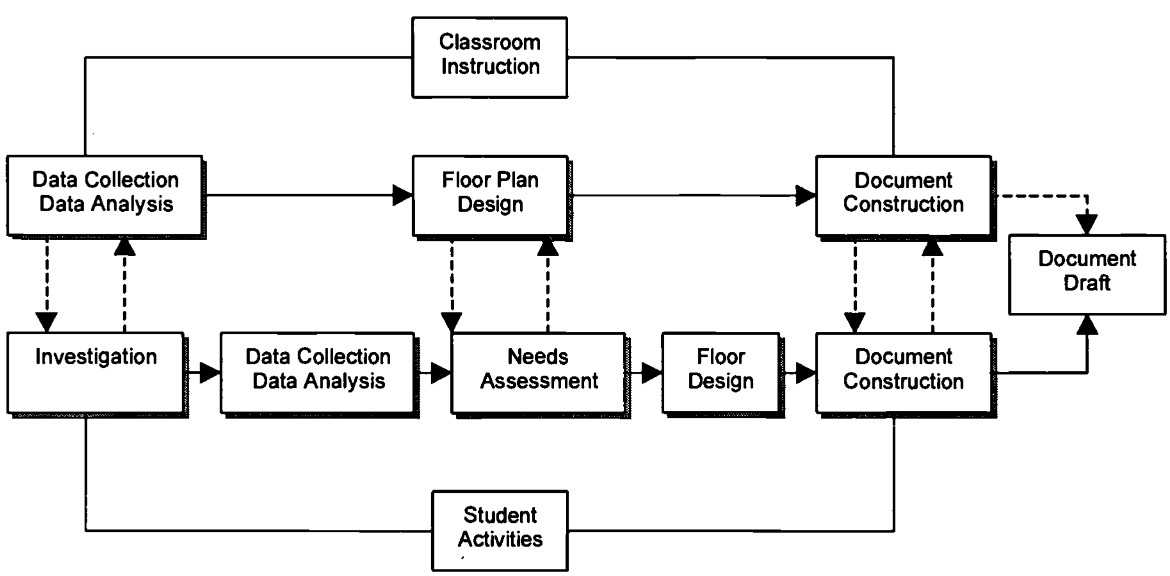

Figure 1: Classroom Model

Finally, as a culminating activity, each student was asked to construct a written technology planning document – a technology plan, based on their investigations, needs assessment, data collection and analysis, as well as the blue prints of their "dreams" and other class activities. Emphasis was given, during this step, to the phases, process of document writing, and such critical issues as public relations, committee members, equipment, facilities, special needs learners, security, professional development, networking, community resources/involvement, maintenance, funding, budgeting, implementation, evaluation, and other items as appropriate for individual schools and districts. Students also developed a working awareness of the on-going characteristics of some of the critical issues such as professional development, community involvement, and evaluation.

Student Activities

Outside the classroom, student activities began with their investigations of the existing technology facilities and equipment in their school districts or campuses. They examined their computer facilities, media facilities, inventories of computer hardware/software, equipment holdings, network status, budget and fund information, administrative system, technology missions, goals, and objectives, philosophies, purchasing, computer facility usage policies, and other related areas. Some of the students held meetings and discussions with their colleagues at school, explaining what they were doing and why they were doing this, so they won support for their information gathering and data collection. With their skills in computer applications, the students compiled the information and data they collected in a variety of formats, such as inventory tables, administrative flowcharts, demographic diagrams, or statistical graphs, as well as statements and narratives.

Having completed their examination of the existing technology conditions in their campuses or school districts, the students conducted data analysis and a future needs assessment for their campuses or school districts. These activities enabled the students to see where their schools are and where they need to go. Based on these activities, the students designed or redesigned (if the campus had already had a floor plan) the floor plans according to their future facility and equipment needs. The students drew out their facility floor plans, computer lab floor plans, network layout designs, wiring designs, power supply floor designs, as well as lighting layout designs. Each plan or design included equipment, furniture, and cost specifications as well as explanations.

In the end, each student constructed a technology plan for his/her campus or school district, based on the investigation, data collection and analysis, future needs assessment, and floor plans he/she did on that particular school or school district. Students focused their attention on the planning process, skills and techniques of plan writing, and critical issues related to their schools or school districts. Meanwhile, students compared their documents with the any existing technology plans at their schools, and obtained feedback from persons at their schools. Then, modifications were made to improve the plans according to the results of this comparison and feedback.

The student activities were not left unattended. Each major activity was carefully monitored by the instructor, and often their classmates, as students reported their activities either orally in class or turned in parts of their projects to get the instructor's advice, suggestions, and corrections if necessary. Therefore, a constant interaction between the student activities and the instructor, as well as feedback from each other, combined to assure that all student activities were on the right track.

Student Feedback

These graduate students were very surprised to discover how many details are involved when planning for technology. It was easy for students to see how certain components are overlooked. Students found that one very crucial element in the planning process was getting the support and involvement from the faculty, students, administration, school board, and the community. After all, the faculty and students are the main users of the technology, and the administration and school board make the final decisions on funding. Students agreed that technology planning is definitely not a one-person show. There was also a consensus that the

support of the community was imperative. Community support can be very powerful especially if the school board is not convinced that the technology needs are valid.

Students seemed to value and respect the classroom approach. It empowered them with the guidance, experience, and encouragement to produce a meaningful, clearly written document. As students were required to examine policies and procedures in their schools, and to consult with and obtain information from persons there, a firm connection was made between what they were doing in class and its relevance to their professional lives and duties.

Beyond Classroom Effects

Students attending this graduate Educational Technology class were basically school technology coordinators, library media specialists, librarians, instructional technology specialists, and K-12 teachers. Most of them are now taking the lead in their school's technology programs. With their new awareness of the needs for and procedures involved in technology planning, they now know to monitor (or become more actively involved in) technology purchasing, installation, management, instruction, training, and other related activities. Almost none of them had ever been involved with technology planning before attending this class, not knowing where to start or how to plan for technology. However, their classroom activities have helped these teachers understand the importance of planning – they realize that they now have the knowledge and skills to participate in the technology planning processes in their schools or school districts. Each of them has constructed a technology planning document; this can be compared with any existing district or campus documents, shared with others, and used to help update current plans. As a follow-up activity, these students, as they go back into their schools and assume their roles as teachers, will continue what they have begun, to make their plans more adaptable and acceptable, by checking with technology committee members, reporting to schools and school districts, assisting with committee evaluations, and the like. It has been rewarding to note that these educators' hands-on technology planning experiences have already initiated technology planning in some schools and school districts.

The class experience, on the one hand, has provided an opportunity for us teacher educators to see what the school technology coordinators want to know and what they need to know about technology planning before their actually initiation of a technology plan. Additionally, it also enables us to see what needs to be improved in our university curriculum in order to meet the needs of the schools whose teachers are attending our classes.

This approach, beginning with student investigation of current situations, has another major benefit. It helps university faculty develop ongoing awareness of the changing technology scene in the schools, which helps provide course content that addresses the ever-changing needs of our current and future teachers.

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FACULTY DEVELOPMENT

Old Computers, Reluctant Faculty, and Emerging Educational Technology: Breaking The Cycle

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Abstract: The teaching profession often suffers from having too little too late. School district budget building does not usually include adequate funds for comprehensive staff development; rather spasmodic, short sessions are provided. High cost, equipment intensive, skills laden educational technology requires more than ordinary attempts to update curriculum through staff development. Extraordinary effort is required for higher education institutions to adequately prepare pre-service teachers for using technology as a tool and to develop strategies to assist school districts for in-service teachers with technology expertise. This document describes the commitment of one higher education institution to be a catalyst for change among its teacher education faculty and in area school districts. Louisiana State University in Shreveport, in collaboration with area schools and the BellSouth Foundation has created an academic program that serves to equip both teacher education students and classroom teachers with skills necessary in today's classroom.

Over the past twenty years, teacher education units in higher education institutions have struggled to provide appropriate education and training in educational technology for aspiring and in-service teachers. This situation exists for many and varied reasons. A recent study reported in Education Week (October 1, 1998) vividly shows that technology is rapidly becoming available in the classrooms of America, but teachers using the technology are slow to respond primarily because of a lack of adequate training.

In the rush to make hardware and software available, a major consideration has been neglected; i.e. pre-service and in-service education of teachers. Undergraduate education is the best means for providing needed skills in the schools of America. Graduate and staff development programs must be geared toward filling the void of technology skills of the current teaching force.

Several barriers exist to the preparation of educators with educational technology skills. Following is a description of common barriers faced in teaching and a description of how one institution has responded to the challenge. Louisiana State University in Shreveport has developed a technology component for it's teacher education program that has met the need to change and to be a leader for change in the public and private schools of it's service area.

Barriers to Preparation of Educators

The Education Unit has less expertise in technology and older equipment than the K-12 Schools

Very often the technology course is assigned to a faculty member in addition to their normal teaching responsibilities. It is added on, it is not their primary responsibility. In other instances, the responsibility for

teaching a technology class is abdicated entirely by allowing the computer science department to teach the classes. The solution to this problem seems obvious, hire a full time faculty member just for technology. It also seems that a good place to hire them is from the K-12 Schools.

The administration will not replace outdated equipment and software
With increasing costs for everything, colleges and universities are hard pressed to allocate enough resources to keep up with the constantly changing demand for newer technologies. If colleges of education are to keep up with technology then they must look at grant writing as an ongoing process, just as they do with budgeting or curriculum revision. Without a continuing flow of grant money the college of education programs will always be old and obsolete.

Not enough equipment for all classes to use technology
There will never be enough money for every instructor to have sufficient computers for his/her classroom. On the other hand if a student lab is open 7 days a week and a teaching lab is available to the faculty on a sign up basis and computers and projection systems on rolling carts are provided on a check out basis for students and faculty, computers are not needed for every instructor.

Many of the faculty members are reluctant to use technology in their classes
Most faculty members want to use technology in their classes. They do not use technology in their classes because they do not know enough about it and their students know more than they do. In order for instructors to use technology in their classrooms they need computers in their offices, training, and support from the technology person in their college. Also students who take a foundation technology course early in their program are pressing the faculty to let them use these technologies in their classes.

Many school districts have their own staff development technology classes
It is very important to point out to school districts the difference between a three hour workshop on how to use PowerPoint and a one semester technology course that is sequential, comprehensive, requires extensive outside work, and integrates the technology into the classroom curriculum. Coordination is essential for district administrators to realize there is a need for both district level staff development and in-service courses by the university.

Although many barriers exist, beginning teachers should be prepared to enter classrooms where multimedia use extends from pre-school through high school in all subject areas. To accomplish this, a shift in emphasis is required in higher education and teacher education in particular. A report by the Southeast and Islands Regional Technology Consortium SERVE, Incorporated (1998) states that "the required general technology course is more common than having technology integrated throughout the pre-service teacher education curriculum" (p.37). This major study found that in the Southeast and in the Northwest teacher preparation programs are making progress in faculty support and development but much more needs to be done to fully integrate technology into pre-service programs.

Early Introduction to Technology - The Key to Integration

Offering a foundations technology course early in the pre-service program has many advantages. First, it makes the integration of technology into other courses easier. The students are already familiar with software, hardware, and how these tools are used in an educational setting. The instructor gives the assignment and does not need to worry about the mechanical details of the assignment. The student lab is always open so there is never a problem about a student having use of the lab. Second, because every education course has a technology component, students become accustomed to integrating technology into their other courses. Thirdly, instructors have an opportunity to extend and expand use in upper level courses. In the foundations course a student may evaluate one drill and practice math program and learn about spreadsheets for math. In the math methods course the student has the opportunity to learn about many different software programs for math as well as more in depth

use of a spreadsheet program. This early introduction to appropriate educational technology is essential to successful integration at all levels – pre-service and in-service.

In-service Collaboration

The higher education model of the past has been teacher/student/classroom/14-16 weeks/3 hours per week. To change this pattern in teacher education so that learning is continuous for the classroom teacher, we must be in a transformation mode in higher education. It must be "realized with three conditions: 1) the changing nature of information, knowledge and scholarship; 2) the needs of individual learners; and 3) the changing nature of work and learning" (Dolence & Norris, 1995). This transformation is particularly necessary in teacher education. Collaboration with schools, business and industry, and community agencies is a necessary component of the new paradigm, which requires higher education to re-think expectations of faculty members, and to restructure the traditional rewards system.

Several steps have been taken at Louisiana State University – Shreveport to make the transformation to a collaborative effort in educational technology. This collaboration involves at least five public school districts with over 100,000 students, the State Department of Education, the Regional Service Center, and the BellSouth Foundation.

The first step taken by the university was to hire a practicing educational technology faculty member who had worked in area school districts for several years. This move brought immediate credibility to the university and it's commitment to quality pre-service programs as well as its new direction in having community partners.

The faculty member has served continuously for five years on the technology committee of two large school districts, has assisted the regional service center in writing proposals, and has worked with several local schools and districts to get tuition exemptions for teachers who are taking educational technology courses. He has been an active participant in the development of new teacher licensure programs in educational technology. He has kept an up-to-date laboratory by writing grants for equipment and software and has been a catalyst for appropriate use of a technology fee assessed in all courses on campus.

Another major step toward improving pre-service and in-service education has been the whole unit's efforts at obtaining grants of significance. A two-year award from the BellSouth Foundation has provided funds for training nearly 100 teachers to be educational technology resource teachers in their schools. Each has taken four courses at the university using BellSouth funds, school district funds, and funds from the State Department of Education. These teachers have rapidly become a valuable resource for schools and teachers in the area.

Another major step in the process at Louisiana State University – Shreveport has been attention given to National Standards for Educational Technology developed by The International Society for Technology in Education (ISTE) (1997) and adopted by The National Council for the Accreditation of Teacher Education (NCATE). NCATE standards have several indicators, which require attention to technology in both basic and advanced programs in Standards IC, ID, IIC, IIIA, IVB and IVC (1995). Each course in teacher education carries a technology component. Faculty members have responded actively to staff development designed to acquire necessary skills to keep them current in educational technology. Some are currently preparing to use multi-media in compressed video courses. Eighteen foundation guidelines were developed by ISTE and endorsed by NCATE and can be divided into three categories:

Basic Technology Operations and Concepts
Personal and Professional Use of Technology
Application of Technology in Instruction

Work with students, college faculty members, and in-service teachers is based on these guidelines and standards.

Administrative Challenges

Higher education administrators face numerous challenges in today's campus environment. First and foremost is the changing nature of funding, particularly in state assisted institutions. Administrators are forced to look in all directions to find funds to remain effective in education and training of in-service and pre-service

teachers. Business partners, foundations, and government grants must be exploited for funding assistance. The traditional roles of the department chair and dean have changed in that they must be fundraisers in order to keep programs current, especially technologically.

A second challenge is to keep higher education faculty ahead of the curve in the use of educational technology. At Louisiana State University in Shreveport this is being accomplished through staff development but more effectively through college-wide curriculum development. All faculty members have been involved in intensive study of the teacher education curriculum in sessions conducted with a consultant at off-campus sites. In analyzing curriculum it becomes apparent to faculty members that certain elements must permeate the program. One of these is the proper use of technology in pedagogical processes.

A third challenge for administration is the interface with K-12 schools. Colleges and universities are faced with the necessity to be proactive in creating opportunities for the schools to partner in staff development for college and K-12 faculty. This requires much collaboration in grantsmanship and expanded K-12 teacher/administrator participation on higher education committees and task forces. Activities such as these forge new and different relationships that have led Louisiana State University – Shreveport to hire public school teachers as teachers-in-residence. The school also uses classroom teachers to teach an appropriate percentage of methods courses to assure recency of experience by those teaching prospective teachers. These professionals chosen for their variety in teaching skills, bring up-to-date educational technology usage as a part of their repertory.

In each of the above challenges, the quality and quantity of commitment is the key to the solution. Administrators must give primary effort to the establishment of commitment by themselves demonstrating commitment.

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Developing Web Pages for Course Enhancement

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Abstract: A series of seminars are described which were offered to assist faculty in the planning, development, production, and utilization of Internet-based materials for enriching their classes. The seminars facilitated the discussion of using the World Wide Web to enhance course presentations. The four levels of seminar material presented were Internet Web-browsing (for the uninitiated), HTML and Basic Web-page Design, Using the Web for Course Development, and Managing Courses using the WWW. This paper describes the specifics and results of the faculty seminars including a description of the materials utilized.

1. Introduction

This paper provides a summary of faculty development activities funded by a local campus Faculty Development Committee. During the spring, 1998, semester, a series of seminars were offered to assist faculty in the planning, development, production, and utilization of Internet-based materials for enriching their classes. Four levels of material were presented. The seminars were available to all local faculty members and were presented to facilitate and encourage using the World Wide Web to enhance course presentations. The four seminars were:

* Internet Web-browsing (for the uninitiated)
Netscape and Web-browsing, Internet Resources, Searching and Bookmarks, View Source and Save As, Graphics and Images, Audio and Video.

* HTML and Basic Web-page Design
Basic Web-page Elements, HTML Coding, Page Design Considerations, Editing - WORD, Netscape Gold, & Office '97, Utilizing Multimedia, and Web Publishing Strategies.

* Using the Web for Course Development
Converting Existing Course Material, Research Links for Student Exploration, Tables for Data Presentation, Advanced HTML Applications, and HTML Editing Programs.

* Managing Courses using the WWW
Blending Content, Function, and Style; Using E-mail and Forms for Student Feedback; CGI Scripts for Data Collection; and On-line Interactivity (including PowerPoint presentations and quizzes).

The first seminar was open to all faculty members without prerequisite. The other seminars assumed a certain amount of "computer literacy," including the ability to work with and navigate between multiple open windows and applications. Also required was a clear understanding of the concept of "copy and paste" between applications. Participants received a disk containing examples and assignment material. Seminar information was also maintained on the Internet. Each session accommodated twenty faculty members and lasted approximately one hour 45 minutes.

A total of 17 seminar sessions involved a total of 50 different local faculty members. Most faculty members attended multiple sessions. At each seminar session, participants were provided a folder containing material related to the seminar session and a diskette containing various sample Web pages and exercises. The paper describes these materials. Participants developed Web-based computer materials during the hands-on sessions.

2. Seminar Specifics

All seminar sessions were conducted in a computer-equipped classroom with 20 Windows '95 based computers and an instructor's station with computer and projector. The sessions were mostly "hands-on" with guided exercises. Software applications utilized included Notepad, Word 97, PowerPoint 97, Intemet Explorer 4.0, and Netscape Communicator. Notepad was used in the development of HTML code. The "Save As...HTML" features of Word 97 and PowerPoint 97 were used to save documents and presentations as Web pages. Additionally, the Web editing features of both Netscape Communicator and Internet Explorer were utilized in constructing and editing Web pages. These software tools greatly enhanced converting material to the necessary HTML code. Although several faculty members were using Web software such as Microsoft FrontPage or Adobe PageMill, these were only briefly mentioned as possibilities for Web-page development.

The series of seminars and the scheduled meeting times were announced with a general mailing to all University faculty. The first seminar topic, Internet Web-browsing (for the uninitiated), was a "quick-start" introduction for those few faculty members not yet conversant with the Web. Most faculty members at the university have previous experience with Web-browsing. The author had conducted Internet workshops during the 1994-95 academic year for approximately 200 faculty [Atkins 1995], and many others learned about the Internet on their own. The topics covered in the first seminar sessions were based on the author's experience with presenting Internet workshops to K-12 school teachers the previous summer [Atkins & Badgett 1997]. Special emphasis was placed on accessing and acquiring multimedia resources.

For the remaining seminars, a participant diskette was prepared containing an overview Web page with links provided to access other diskette-based resources for each of the three primary topics of the seminars. These topics were HTML and Basic Web-page Design, Using the Web for Course Development, and Managing Courses using the WWW. In addition to providing participant resources on diskette, a seminar Web page was maintained at Blackboard Classroom. Blackboard, Inc. provides the free site for posting course Web pages "for instructors who do not have the support of their academic institution and it is free [Wang 1998]." They do, however, charge for any required technical support. Their Web address is http://www.blackboard.net/. The Web-site provided for the posting of announcements, assignments, and on-line quizzes. It also provided a convenient mechanism for communication between the participants and the instructor. Another product offered is Blackboard CourseInfo, which is to be installed on an institution's server. Information about CourseInfo may be found at http://www.blackboard.net/courseinfo_frame.htm.

The overview page included simple graphics, a variety of heading sizes, horizontal rules, and links to the lessons and exercises for each seminar. In the HTML and Basic Web-Page Design session these items were shown to the participants in both the browser window and as source HTML code. This provided a simplified discussion of the tags associated with the elements off a Web page. The <HTML>, <HEAD>, <BODY>, <CENTER>, <HR>, <IMG SRC>, and <A HREF> tags were demonstrated and discussed. A border graphic was also used to illustrate the use of the <BACKGROUND> tag.

Once these preliminaries were covered, participants were guided through their first exercise that included the HTML elements above, a variety of heading formats, and ordered and unordered lists. Notepad and the browser window were opened side-by-side with participants making changes to the HTML code, saving their changes, and then reloading the browser's page to see the effect. This provided a very useful environment for learning. This session on HTML and Basic Web-page Design concluded with a brief discussion and demonstration of using the editing features of browsers to modify Web pages.

The next seminar was entitled Using the Web for Course Development. It focused on converting existing course material to HTML and providing links for student exploration. The use of tables in presenting and formatting Web-based material and using the "Save AS...HTML" features of Word and PowerPoint for posting current course documents and presentations were also discussed and demonstrated. Again, participants were provided guided exercises. Each participant created a personal Web page with links to course material.

The final seminar was entitled Managing Courses using the WWW. Participants were introduced to the concepts of using e-mail and incorporating forms into their course-based Web pages for enhanced student feedback. The utilization of CGI scripts for data collection was demonstrated. Much of the seminar session was devoted to developing on-line interactivity. JavaScript and PowerPoint were used as examples. The emphasis of this final session was the use of Web pages to allow students to access and interact with course material outside of the classroom. The overall goal of the seminar series was to illustrate and facilitate the development of Web pages for course enhancement.

3. Results and Conclusions

Fifty faculty members attended the seminar sessions. The number of faculty attending the various sessions ranged from three in the smallest to 15 in the largest. A majority of the attendees were primarily interested in simply learning more about the Internet and Web page development. The second and third seminar topics--HTML and Basic Web-page Design and Using the Web for Course Development--were the most popular, with an average attendance of eight per session.

Several problems associated with the presentation of the seminars were the usual ones to be expected when dealing with university faculty. First, there was a significant range of computer literacy and Internet experience skills. Some participants' expectations were simply too high for their level of computer background and experience in using the Internet. Finding the "happy medium" in the presentation of material was difficult, and some faculty struggled with the material presented. A pretest to determine the level of participant experience would have proven helpful. Second, university faculty members are busy individuals and "no shows" were both a problem and a disappointment. To assist in planning and conducting the seminars, faculty members were asked to schedule the sessions they would attend. Those who missed sessions and later attended a subsequent session caused confusing for both the faculty members and the seminar instructor. For future seminars, a survey of interest will be conducted in the preliminary planning phase, and a participant pretest will be developed to assist in targeting the material at the appropriate level of presentation.

Seventeen faculty members attended all three of the Web development seminars. They indicated significant interest in using the Internet and Web pages for course enhancement. The utilization of Web-based resources to enhance course delivery has increased as a result of the faculty development seminars.

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Faculty and Students Learning Together

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Abstract: Across the nation, video-cassette recorders flash 12:00. Go ahead; let your niece reset the time and program the recorder for a movie tonight. But what about the technology hardware and software that you use in your classroom? Here in the hallowed halls of higher education, the last bastion of intellectual rigor, the young student often knows more about the computer and other technology, than the instructor. So why fight it? Let's join it. A plan has been set in place on this campus, to provide for support and recognition for those faculty willing/wanting to step forward and incorporate technology into his/her insturction. Unlike most tertiary campuses, the faculty has stepped forward and made a declaration to attend to and include technology in their instruction, communicating with the students, and providing the most up-to-date research tools available. For us, the biggest and perhaps most amazing thrust of the technology on this campus, is that which has been accomplished by the individual wishes and works of faculty, in concert with peers and students. Let's see how this works.

Taking the Training Wheels Off: The Use of Mentoring for Faculty Development in the Integration of Technology

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Abstract: This paper describes a collaborative approach to help college of education faculty integrate technology into their teacher education courses. In order to increase the modeling of technology within these courses, a mentoring program was created which matched graduate students in instructional technology with interested faculty members. This paper reports from the mentor's perspectives the factors that made this innovative approach successful.

The effectiveness of technology in school settings depends on how successfully teachers integrate it with their educational goals and curriculum. Money spent on school technology could go to waste if teachers don't know how to use it and integrate it into the curriculum (Zehr 1997). A 1994 survey by the U.S. Department of Education shows that only 15 percent of the nation's teachers had at least nine hours of instruction in educational technology. If a school's equipment is to be used well at least 30 percent of a technology budget should be spent on professional development. The average figure is just 15 percent, according to a 1993 survey of districts by the research firm Market Data Retrieval (Zehr 1997). An ideal way to prepare teachers for incorporating technology into classrooms is by integrating technology into the college curriculum. University faculty are capable of modeling the use of technology in education. Due to the increasing demands for technology in the classroom, it is imperative that faculty in schools and colleges of education take a leadership role and provide perspective teachers with the opportunity to observe uses of technology in classrooms. If college of education faculty do not model the integration of technology, then teachers will be less able to include technology in their own classrooms (Zehr 1997).

However, such change cannot occur through "one-size-fits-all" workshops, especially when it comes to the integration of technology. Faculty members need individualized instruction. They need to explore software appropriate to their content area and need support as they begin to implement new teaching approaches. The most effective way to move faculty members from personal use of computer applications to the integration of technology into their courses is through working one-on-one (mentoring) where individuals' needs can be addressed (Thompson, Hansen, and Reinhart 1996). The purpose of this paper is to describe such a collaboration between an elementary education professor and a graduate student specializing in instructional technology.

Since Odysseus entrusted the education of his son to an advisor and friend named Mentor over three thousand years ago, the concept of mentoring has become firmly tied to the educational process. Although the term "mentor" is rooted in mythology, it has grown and flourished throughout the history of education (Janas 1996). Today, not only are mentors linked to the education of students but also to the professional development of teachers and administrators. The term mentor has a variety of meanings. A mentor serves as a role model, sponsor, encourager, counselor, and friend to a less skilled or less experienced person for the purposes of promoting the latter's professional and/or personal development. It is assumed to involve an ongoing, caring relationship. A mentor's role can be synonymous with teacher, coach, trainer, role model, nurturer, leader, talent-developer, and opener-of-doors (Janas 1996). Key features of the mentoring approach are: assistance is provided within the context of a personal relationship and focused on the individual needs of the protégé; the isolation characteristic of the teaching profession is broken down; collegial interaction and reflection are encouraged; and school-based collegial support needed to help teachers learn to integrate computers into their instruction is provided (MacArthur, Pilato, Kercher, Peterson, Malouf, and Jamison 1995). A mentor helps the protégé obtain knowledge or skills needed in order to prosper in their chosen profession. In this situation, faculty members need a mentor who can enable them to use technology effectively and understands their anxiety about change. Such a relationship can provide faculty members with the support they need as they move from personal use of computer applications to the integration of technology in their courses.

A faculty mentoring program has been in effect in the College of Education at Iowa State University for the past several years. The Department of Curriculum and Instruction has created a one-on-one mentoring program for teacher education faculty that has helped faculty acquire the skills necessary to effectively integrate technology into their courses. Faculty members are mentored by a student with a specialization in instructional technology. The mentor is simultaneously enrolled in a class entitled "Technology in Teacher Education" (CURR 610). This class meets once a week so that class members may share experiences and ideas on technology and the mentoring process, explore the issues surrounding the integration of technology in the curriculum, and study key issues in the application of technology in the educational process. Together, the faculty member and mentor work on technology applications that relate to the faculty member's teaching interests. For the field experience component of the course, each mentor provides one-on-one assistance in order to help the faculty member integrate technology into his/her teaching (Thompson et al. 1996).

In order to assess the value of this experience, qualitative measures were used. The primary source of information for this study was the journal kept by the mentor after mentoring sessions with the faculty member. A secondary source of information was a post-mentoring survey administered to the faculty member that gave her the opportunity to express her impressions about this experience.

BACKGROUND INFORMATION

The Faculty Member: Donna

Donna, a teacher education faculty member, is an associate professor in the Curriculum and Instruction department. She began her educational career as a middle school teacher where she taught German, French, English, and reading. She currently teaches courses on elementary education and reading, elementary education strategies in teaching, and secondary education and reading. When asked to describe her initial perceptions of technology in education, she had a lot of comments.

> *"I avoided all of the Apple stuff. I never touched it. I had a lot of anxiety. I did not want to do something that I might not be successful at. I became embarrassed because peers (and students) were doing things and I couldn't match their levels."*

Donna was asked what her expectations were regarding technology training. She enumerated the following items.

1. Increased confidence,
2. Improved knowledge of software,
3. Ability to develop strategies for computer use/integrating the computer into classroom activities,
4. Increased computer skills/competency,
5. Increased use of the computer, and
6. Gain more understanding of the computer as a learning tool.

Donna confessed that she had a limited level of personal and classroom experience with a computer. Therefore, her reasons for pursuing technology training were mainly due to interest, enjoyment, and curiosity.

The Mentor: Endya

Endya is a doctoral student in the Curriculum and Instructional Technology program. Her undergraduate and graduate degrees are both in Agricultural Economics. Therefore, her technology experience prior to enrolling in the Curriculum and Instructional Technology program involved basic word processing and complex statistical programming using software packages such as SPSS and SAS. Endya changed her academic focus from agriculture to technology in order to learn how to integrate technology into the field of agriculture. Since enrolling in the program, she has had the opportunity to use and experience many new and innovative technologies. When asked about her impressions of technology, she had the following to say:

> *"My perceptions about technology and mentoring are positive. I believe that technology can be used to enhance both learning and teaching. Furthermore, I believe that my willingness to learn, patience, and understanding will prove beneficial to the mentoring relationship."*

THE MENTORING PROCESS

In order to stimulate reflection on the mentoring process, a journal was kept concerning the progress of the mentoring sessions and the mentoring relationship. The journal also provided an opportunity for the course instructor to understand what was happening in the mentoring relationship and to provide comments and suggestions.

One of the most daunting tasks for a mentor is getting the whole process under way (MacArthur et al. 1995). The most obvious starting point for the mentorship was the first mentoring meeting. At the first meeting Endya and Donna took advantage of the first formal moments to get to know each other's background, to develop goals and to establish meeting times. Their mentoring goals were as follows:

Primary Goal: To integrate technology into the classroom.
Secondary Goals:

1. To work as a team.
2. To have fun while learning from and about each other.
3. To use *HyperStudio* in an elementary education course.
4. To use *CU-See Me* technology with a group of elementary students in the school district.
5. To create a website (with links) for the students' access.
6. To master the before-mentioned technology in such a way that students will be motivated to learn more about it themselves.

Although Donna was eager to learn about technology and its uses in the classroom, she admitted that she was not very confident in using the computer as a learning tool. The immediate goal was for her to become comfortable and confident with the technology. Endya's goal, as a mentor, was to guide Donna so that eventually she would be able to integrate technology into her courses.

Donna's first goal was to learn *HyperStudio*. Neither Endya nor Donna had worked with it, so it was a learning experience for both of them. During the next seven weeks, their meetings revolved around *HyperStudio*. They spent some time on basic functions of the program, after which they advanced into more complicated designs. During this period, Donna and Endya increased their technical knowledge. For the *HyperStudio* project, they were required to use the computer image scanners, to use *ZIP* drives, and to go "web surfing" for project background

information. These were collaborative efforts because they required teamwork not just between the Endya and Donna but with staff members in the technology lab and with other faculty members. During the weeks they worked on the *HyperStudio* project, Endya watched Donna grow. At the outset of the project she was apprehensive about "clicking the buttons." However, as the weeks progressed, Donna would go to Endya and express with enthusiasm that she had worked on the project by herself the day before or over the previous weekend.

Their next meetings were deemed "discovery sessions." During these times they visited the technology lab to learn about the *CU-See Me* technology and to talk about *ClassNet*. With the *CU-See Me* technology, Donna did not want any formal introduction or training. Therefore, they reserved the equipment and a set of instructions and they only walked through the use of it. *ClassNet,* on the other hand, is a system designed at Iowa State University by which classes may be offered via the Internet. Endya had learned about this concept through the CURR 610 course. When she spoke to Donna about this, Donna was excited. They went step-by-step through the procedures to form a class on the Internet. They also established an electronic mail (e-mail) connection with one of the designers of the system in case they had any difficulties. Donna remarked that "*there are a lot of possibilities for a system such as this*."

By this point in the mentoring program, Donna and Endya had covered a lot of ground. However, an important moment was yet to come. Donna had to deliver a presentation at a national conference. The presentation involved English instructors and the integration of technology into the English classroom. Donna wanted to use *PowerPoint* for her presentation. She had experience with the software, but the experience was limited and it was with an older version of the program. She was experiencing anxiety about her presentations. Over the next couple of weeks Donna and Endya worked together to design a presentation that Donna was proud of. That was not the end of it, though. Donna had to take her own equipment to the conference. Therefore, she had to learn how to set up the hardware so that her presentation could be viewed by the audience. Donna and Endya reserved a classroom and the necessary equipment and they worked together (and with technology staff members) to get her accustomed to the hardware. The results of their work paid off. Donna went to the conference and her presentation was a success.

Their final goal in the mentoring relationship was to learn how to create a website for Donna's classes. Once again, this is an area that both of them had no expertise in. Endya enlisted the help of several of her fellow mentors because they had mentioned their web expertise during the weekly CURR 610 sessions. With the other mentors' help (and a couple of informative handouts), Donna and Endya were on their way. They used the *Claris HomePage* software to create the web pages. Donna worked on the computer as Endya guided her. They both found the process to be especially easy. It was so easy that Donna felt capable to work on the web pages on her own time.

Even though these experiences involved only Donna and Endya, they had a direct impact on the teacher education students. Donna's motives for this training were to rise to the level of her students and to increase her methods of integrating technology into the curriculum. Overall, the mentoring collaboration had a positive impact on Donna regarding the potential of integrating technology into her courses. Donna had increased her confidence by taking the initiative to use the technology on her own.

FEEDBACK FROM DONNA

Although Donna was motivated to volunteer for this project because of her desire to learn more about technology, she initially expressed what is defined as "cyberanxiety." Cyberanxiety may appear as a general anxiety about using technology (George and Camarata 1996). George and Camarata suggested that one possible cyberanxiety reduction learning approach is to allow instructors to self-select the location where learning takes place. Choosing the location for the most appropriate and comfortable training session as well as selecting the learning content was very important to faculty as evidenced by the relaxed atmosphere which was created when Donna chose to work where she felt most comfortable (i.e., her office, a computer lab, or a technology lab).

For Donna, modeling technology use was an important variable to learning. She also liked the fact that she had help one-on-one and that her technology needs were being addressed directly. When asked how/if the mentoring experience produced professional changes in her routine, she remarked that:

> *"The biggest change occurred when I was looking at something and really thinking how I could use it with my students. Also, I have a lot more understanding of what students experience when they get frustrated [with technology]."*

She also expressed the importance of the mentor's attitude in developing her technology skills. As she noted:

"The mentor was so knowledgeable, taught so well, and problem-solved. This helped more than anything. She had a pleasant personality, was sensitive to my shortcomings and no question was a dumb question."

Furthermore, according to Donna, the most valuable aspects of the program were:

1. Increased confidence level,
2. Availability, assistance, and expertise of a mentor,
3. Learning a new skill in a supportive and non-threatening environment,
4. Input and sharing of ideas with others,
5. Chance to view a variety of educational software, and
6. General design of the course/program.

There were, however, a few negative comments on Donna's post-mentoring survey. All of these comments dealt with issues such as scheduling conflicts, incompatibility between technology (home, office, and computer labs), software/hardware malfunctions, and a lack of technology resources to complete desired projects. Donna also mentioned that *she "didn't think that one semester was [long] enough. The learning just began by the end of the program."*

CONCLUSION

Teacher education faculty must acquire both technology skills and visions of how technology can improve learning in order to successfully integrate technology into their coursework. The biggest challenge for educators is to move beyond basic technology applications to technology applications that can be integrated into the curriculum. Simply teaching preservice teachers how to use technology is a beginning, but an additional step is needed (Zachariades & Roberts 1995). By forming one-on-one, collaborative teams between faculty members and graduate students in instructional technology, college of education faculty can provide preservice teachers with opportunities of technology integration. Additional ingredients to the success of this approach have been the individualized nature and the self-paced workload of the collaborative team. Unlike a workshop situation, where faculty members might hesitate to ask questions, or probe for software information specifically related to their content area, the one-on-one approach allows for individual faculty needs to be met (Zachariades & Roberts 1995). This collaboration had a positive impact on the faculty member regarding the potential of technology integration into the curriculum. Through collaboration, the faculty member can reach a better understanding of the way a student/mentor learns and is motivated. Also, the student/mentor in turn can better understand the concepts a faculty member wants to present (Heuer, Duffrin, Faskowitz 1996).

Mentoring is a form of staff development for both the faculty member and the mentor. It is imperative that the following obstacles to mentoring (Ganser 1996) are avoided in order to assure the growth of the faculty knowledge base.

1. Lack of time for mentoring meetings.
2. Other responsibilities interfering with mentoring.
3. A mismatch between teacher and mentor
4. Lack of administrative support.

The ultimate goal of the program was to increase the quality and quantity of educational computing use by teachers with their students. Although the program focused on producing outcomes for the faculty member, there were significant results for the mentor as well. The literature (MacArthur et al. 1995; Wollman-Bonilla 1997) suggests that there may be more to mentoring than merely transferring information from the more knowledgeable mentor to the faculty member. Chief among these was the development of solid, enduring relationships with the faculty members and with other mentors. Also, a greater understanding of technology was achieved. Benefits for mentors also include: (a) recognition of their expertise, (b) development of leadership skills, (c) development of professional friendships, (d) opportunities to learn from faculty members, and (e) the reflection on established practices.

To be effective, technology integration methods must respond to the complexity of the process of adopting technology. The mentoring program has proven to be highly appropriate in this area because of its ability to address a broad range of needs and to support an extended process of teacher development. In the end, from an administrative standpoint, this program showed itself to be a cost-effective way to involve faculty members in a technology education program that is sensitive to the individual needs of the faculty and works with the existing technology in the schools.

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Teaching Students Statistics On The PC

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Abstract: With the advent of powerful desktop computers, easy to use operating systems and user friendly statistical packages faculty and especially students now have access to easy to use computer statistical packages. However, due to the level of technology and sophistication of the statistical software packages, students and faculty need to be adequately trained to use this technology. The article that follows provides the reader with an outline and procedures for training faculty and students in the use of this technology.

Introduction

Educational use of and emphasis on technology has resulted in an increase in both the number of personal computers and the quantity of computer-related equipment. However, until recently, most faculty, staff and students were forced to rely on the use of mainframe computers to conduct statistical analyses. Due to limited access and the difficulty of running statistical packages on the mainframe, training in the use of these statistical packages was largely left for graduate students and faculty who were conducting research. Additionally, many students have a negative attitude toward statistics, and may also have a great deal of anxiety about using the computer to solve statistical problems. With the advent of powerful desktop computers, easy to use operating systems (Microsoft windows) and user friendly statistical packages which operate within these operating systems, faculty, staff and especially students now have access to easy to use computer statistical packages.

With the development of this technology and statistical software, it has become apparent that students and faculty alike can now use this technology on a regular basis. However, due to the level of technology and some of the sophistication of the software packages, students and faculty need to be appropriately trained to use this technology and software. This article provides the reader with a format and a basic strategy for training faculty and students in the and out of class with how to use this technology to enhance their learning experiences and provide them with a valuable skill which may be beneficial for their future. Additionally, it is hoped that if students and faculty have the ability to calculate statistics in a user friendly environment that is not overwhelming and does not require programming skills that more people will be open to conducting research and adding to the knowledge base of education and psychology.

Faculty Training

To be able to adequately train students in the use of these fairly new personal computer statistical programs, faculty need to be fully trained and understand the workings of the statistical package. Once faculty are fully trained and comfortable with the statistical package they will be able to share this knowledge and their technical skills with students. Two basic approaches can be employed to train faculty. The first approach is to have faculty attend a workshop or seminar on the statistical package that will be employed in classes or used by the academic department. Typically, these workshops or seminars are conducted by the software developers and cover the basic operations and use of the program. It should be noted that these seminars/workshops do not cover actual statistics, but just how to get the computer statistics package to give you the results of statistical operations. Although, this approach may be the best overall approach to training faculty, due to time constraints, expense and willingness of faculty to participate, this approach to training may be difficult.

A second approach, which is much more flexible and can be modified to meet the needs of individual faculty members and academic departments, involves three steps. However, before this process can be set into motion all faculty must be familiar with basic computer operations and uses. Since most faculty are already using computers on a regular basis, it is usually assumed that they already have basic knowledge of computer use and

operations and are familiar with their operating systems (Microsoft windows). If faculty members are not familiar with basic computer operations and operating systems they must first be trained on these aspects of computers before they can be trained on the use of the statistical packages.

The first step to actually train faculty is to have at least one, preferably two faculty members attend a workshop or seminar on the use of the statistical package. By attending a workshop these faculty members should learn all of the intricacies of the statistical package. Additionally, through the workshop this/these faculty member(s) should be able to master the operations of the statistical package and have the basic knowledge and skills to train other individuals in the use of the statistical package. Now with having at least one faculty member formally trained in the use of the statistical package we can move to step two in the training phase for faculty.

The second step is for the faculty member(s) that have been formally trained on the statistical package to provide seminars/workshops to other faculty members on how to operate the statistical package. A second trained faculty member is recommended to lessen the demands and burden that may be placed on only one individual knowing the details of the statistical package. At this point the faculty trainer(s) provide other faculty with the basic operations of the program, while the intricate details of the program are left for individual instruction. It is recommended that the intricate details of the program and higher level statistics that go beyond what is typically used by most people be left for individual instruction for two primary reasons. The first is that the number of statistics that can be accomplished by these programs is immense and would take a great deal of time to teach. Second, many faculty members may have not interest in some of the finer details or higher level statistics as they are not familiar with them and see no need to learn them. Once all faculty have learned the basics of the program the training should move to the third and final step for training faculty. The final step is an active learning process where individual faculty members are instructed to explore the statistical package with their own data or sample data that is provided. Through the active learning experience with the technology and statistical package individual faculty members are able to discover and construct knowledge about the statistical package through active engagement with the statistical package. At the same time, the fully trained faculty member(s) are available to help with any problems that may arise or to provide individual instruction on the finer details of the program or higher level statistics. Through this training experience faculty members are able to learn the details of the statistical package for their own use, but also should possess the knowledge and skills to teach the statistical package to students.

Student Training

Once all the faculty are trained, especially the individual instructors who will be teaching the statistical package to students, the task of training students on the statistical package can begin. When it comes to teaching students and training them on the use of the statistical software for the personal computer several other factors have to be taken into account. First, students need to be familiar with the statistics that will be covered and used in the statistical package. Along these lines, all students who are going to learn the statistical package should have already taken a basic course in statistics. If students have not had a traditional basic statistics course they should not be allowed to learn the statistical package as this will lead to some potential problems. Although any individual can learn to operate a statistical package, without the proper background in statistics students or any individual for that matter will not be able to understand what the statistical package is actually doing with the data. Additionally, the statistical packages only calculate statistics and do not make the decisions about what statistics would be most appropriate to calculate to answer the question posed. This knowledge can only be gained by a basic knowledge of statistics. Finally, the anxiety that many students feel related to taking a statistics course should be dealt with to increase motivation for the class and learning of the material. As has already been mentioned many students have a negative attitude toward statistics and this view or attitude may hinder learning and performance in the class. This can usually be dealt with by taking some time at the very beginning of class and discussing some of the pertinent issues with the students. The instructor should inform students of the focus of the class (mainly to learn the statistical package), appropriate ways to learn the material (hands on and do not wait to the very end), and assuring students that with a little effort on their part they will have no difficulty learning and mastering the material.

To actually teach and train students on the use of the statistical package it is preferable to do so in a class format. To conduct the class, the instructor and students must have access to a computer lab, which has enough computers for each student and has all the necessary software loaded on the computers. Typically, this will consist of a computer lab, with at least 20-25 personal computers which have Microsoft windows and the chosen statistical package loaded. Due to the interactive nature of this class and the potential for students to get into trouble with the software package, it is recommended that no more than 20-25 students be in the class. Before actual training on the

statistical software can begin the instructor needs to make sure that all students in the class have the basics of computer operations and operating systems. To facilitate this process, it is recommended that during the first class, the instructor survey the class and determine the level of computer knowledge of the class. Once this is determined the instructor can tailor the basic computer skills instruction to the level of the class and not waste time repeating information that is already known. This procedure will allow the whole class to start off on the same page and will ease the learning of the statistical package. This may seem a trivial point, but experience has shown that classes that have students at different levels leads to difficulties as students with experience tend to jump ahead and get into trouble with the program. While at the same time less computer experienced students also get into trouble with basic operations of the computer. This leads to a great deal of difficulty on the part of the instructor who now spends a great deal of time working with individuals to get them out of difficulties instead of teaching the whole class.

Hopefully, with the whole class on the same page, the instructor can start to teach the basic operations of the statistical package, such as file management, data entry, variable defining, etc. Students should be given active learning experiences with these aspects of the statistical package so that they can become engaged with the program and discover and construe knowledge on the workings of the basic aspects of the program. Once the basic operations of the statistical package have been mastered, the instructor should move to more advanced data manipulation procedures such as computation of scores from the data, recoding of data, reverse scoring, value labels and other frequently used data manipulation procedures. These aspects may seem easy to some students, but it is important for the instructor to keep students working at the same pace and for those who feel that they are knowledgeable about computers and there operation from trying to jump ahead. Due to the complexity of the operations and the multiple options available in most statistical packages students who jump ahead tend to get into trouble with the software package. This leads the instructor to having to help these students get out of trouble and takes away from actual instruction time on how to use the statistical package. To help students learn and master the more advanced data manipulation procedures an active learning process should be employed again. Students should be provided with a data set at this time and asked to go through a series of data transformation, manipulations and other more advanced operations as desired by the instructor. It is important that all students use the same data set and follow the same set of operations so that the instructor can check the work to ensure that the students have learned and mastered the material. To ensure that students do not cheat and copy the work of more able students the instructor can use the same data set for each student, but use different file names and variable labels. When the results of the assignment are reviewed, the instructor they will be able to see if the student actually conducted the manipulations on their data set and that it was done correctly. It is important to make sure that the actual data remains the same so that the instructor does not have to do the same manipulations on each and every data set. Through this active learning experience students are able to discover and construct knowledge through engagement with the statistical software package and should be prepared to tackle the next phase of learning the statistical package.

At this point students should have the basics of the statistical package down and now the instructor can focus on teaching the students how to run the various statistics that are part of the statistical package. Prior to this the instructor needs to make some decisions about which statistics will be covered in the class. This is partially determined by the level of the class (high school, undergraduate, or graduate) and the types of research questions that will potentially be posed by students. Typically for high school and undergraduate classes, it would be feasible to cover all descriptive statistics, mean comparisons, correlations, basic regression, and ANOVA. For graduate classes, these statistics should be covered as well as more advanced regression, MANOVA, repeated measures M(A)NOVA, and any other higher level statistics that the instructor felt would be beneficial for students.

To help students with the learning of the package and to facilitate understanding of what the statistical package is actually doing, it is recommended that students receive an overview of the statistics that are going to be taught on the computer statistical package. It appears to be most helpful to cover the statistics just before the students are going to learn them on the statistical package. This translates into covering the statistical topic at the beginning of the class in which that statistic will be learned on the statistical package. Covering all the statistics during the first few weeks of the class and then focusing on the statistical package appears to lead to confusion on the part of the students. Following this approach students are able to integrate the two which allows for a deeper understanding of the statistics and the statistical software program. Additionally, with the better understanding of the statistics students are in a better position to understand the meaning of the statistical output.

Once an overview of the statistic has been done, the instructor should take the students through the computer operations to run a particular statistic step by step. Use of a computer projector is highly recommended at this point so that students can actually see the operations of the statistical program. Once students have been presented with how to run a particular statistic, it should be practiced several times in class to ensure that students

know how to run the statistic and have had the opportunity to ask questions. This eliminates one of the common complaints of students, namely that they were not sure what they were doing when they went to work on their own. Once students have been trained and mastered the statistic in class, an active learning process is again used to reinforce and continue the learning process of the software package and statistics, which is reviewed the following week. Additionally, the instructor can provide the students with a data set and have the students run the statistic as a homework assignment which can be evaluated for proper use of the statistical package. This procedure is repeated for all statistics that are going to be covered as part of the class.

By following the format and procedures outlined in this article instructors should be able to develop an environment and teaching style that is conducive to learning of statistics and statistical software packages. Students tend to learn only what is presented to them and if we as instructors can not incorporate the new computer technologies (software) into students learning, we are doing a grave injustice to our students as we move further and further into the technology age.

Using the Web as a Tool for Promoting the Integration of Technology in Teacher Education

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Abstract: The infusion of technology into teacher education has grown tremendously in the past few years with the progression of technology initiatives in K-12 education. In order to facilitate this interest, a web site was developed to provide support for teachers educators in a division of Curriculum and Instruction. This paper reports a study that was conducted to examine the effectiveness of this web site for teacher education faculty and to determine the present status of the infusion of technology in the elementary education program.

Statement of the Problem

Teacher educators are preparing preservice teachers to enter the teaching profession at local, state, and national levels. Each of these levels is establishing guidelines which direct teachers and students to use technology in the classroom. These local, state, and national guidelines (NCATE, 1997) mandate teachers to use technology and to help students become proficient users of technology. Thus, it is paramount that the teacher educators prepare teachers to meet these expectations.

Literature Perspectives

Educational initiatives in many states are beginning to focus upon the inclusion of technology (Fawson, 1992). State curriculum guides and mandates include technology objectives along with the content goals. Many preservice and inservice teachers do not feel prepared to use new technologies and express concerns and fears regarding the integration of technology into their instruction (Heinich, 1991). A report by the Congressional Office of Technology Assessment (1995, pp. 184) concluded that "...overall, teacher education programs do not prepare graduates to use technology as a teaching tool."

Perelman (1992) suggests that failure to teach the necessary technological skills may result in a lack of preparedness that cannot be rectified in subsequent in-service training. Teacher education programs need to capitalize on this opportunity to prepare preservice teachers in order to build better schools for tomorrow (Parkway & Stanford, 1992; Carnegie Forum on Education and the Economy, 1986).

In a study conducted by Flake (1990), the importance of effective, hands-on technology models for preservice teachers was highlighted. The results from this study indicated that student teachers who were initially resistant to the use of computers, overcame this resistance due to the instructor's seamless integration of computer practice into instruction. Flake (1990) reported that not only did the students overcome resistance, but they also became powerful advocates for the integration of technology throughout the curriculum.

Summary of Methods and Procedures

In a recent university division-wide effort supported by a state-funded grant, a task group was formed to develop strategies and a plan of action for the infusion of technology in teacher education. The task group

included university instructors and local school district technologists and teachers. A web site was developed by this task group to serve as an interactive resource for educators. This web site included links to local, state, and national guidelines for implementing technology, resources available at local school and college facilities, and a variety of on-line resources related to curriculum. In addition, the web site offered a WebQuest that navigates users through the available information and promotes their thinking about their role in the infusion of technology. The URL for this web site is http://www.ecc.ttu.edu/projects/baytech.

Teacher education faculty were invited to begin using this site at the beginning of the Fall semester with instructions to continually check for updates. A component of this site invites faculty to submit and share their ideas, projects, and experiences in using technology that will be placed on the site for others to access.

The purpose of this study was to examine the effectiveness of this web site for teacher education faculty and to determine the present status of the infusion of technology in the elementary education program. Data collection included a written survey completed by elementary education program faculty and interviews with 40% of this group.

Results

During the invitation to visit the web site, there was a positive outlook from faculty, however, after the invitation was given, faculty response was very limited. After an entire semester, there has not been any idea/project submissions or e-mail responses to this web site. The results from the interviews indicated some reasons for this non-response.

The written survey was designed to gain an overview of the technological activities that teacher education faculty included in their courses and in course assignments. In addition, information collected from the survey indicated the ideas or interests teacher education faculty had regarding the inclusion of technology. The written survey was distributed to the elementary education program faculty with a 70% return rate. The results from this written survey are shown in Table 1.

Technology Currently Included in Courses	Technology Ideas for Future Inclusions
Word Processing – Written Assignments	Electronic Portfolios
Video Taping – Teaching a Lesson	Exposure to technological applications currently being used in elementary schools
E-Mail – Weekly Reflective Journals	Scanning – photographs, student work, etc.
WWW – Find Resources for Topical File	Review of educational software
Campus Library Computer System – Library reference for Research Paper	More video-taping of lessons for reflection activities
Power Point Software Program – Use to make overhead transparencies for lessons	Including more technology-related applications in field-based lessons

Table 1: Written Survey Results.

The results from the written survey indicated that teacher education faculty were including various forms of technology into their courses and many indicated a desire to include more. As illustrated in Table 1, many of the technological activities currently being used are basic, yet applicable experiences for students. Many current assignments are designed based upon what technology is available to students. Ideas for future technology activities are delayed because there is simply not the equipment or access available to students.

Interviews were conducted with 40% of the elementary education faculty. These faculty members volunteered to participate in the interview process. These were formal interviews which were audiotaped and transcribed for analysis. Results from the interviews are given below with general, overall responses to each of the interview questions.

What do you know about the State Technology Standards and/or NCATE Standards?

All participants indicated that they were aware these standards existed, however they had not read them.

Have you visited the Project Website? Why or Why not?

Most of the participants indicated that they had not visited this web site because they did not have time. One participant indicated that she had brought up the web site on her browser, but she did not explore the options available. One participant did not have computer access in her office, so she couldn't visit the web site.

What do you think is the purpose of the technology course in our Elementary Program?

"To prepare future teachers to become familiar with up to date technology," was the overall response to this question. A couple added the idea of making connections to curriculum in the K-12 classroom.

How do you see your role in the technology preparation of our students?

The overall response to this question was "to provide technology-related assignments or to strongly encourage students to apply the technology they have learned to current assignments." One participant defined her role as an attitudinal role. She felt that she did not have expertise in technology to assist students, but she could affect their attitudes.

Do you have any ideas for integrating technology into the Elementary Program?

There were a variety of responses to this question, but one response that was common to most was the idea of simply sharing ideas among faculty. Other responses included using more video-taping to reflect on teaching, making better connections with K-12 schools, and including more technology-related assignments in courses.

What are some limitations or barriers for integrating technology into teacher education preparation here at the university?

The big response to this question was access for students and faculty. Some mentioned availability and current status of the equipment in K-12 schools. One participant brought up the limitations of the field-based program in which students were not on the university campus for the entire semester.

What kinds of support do you need or are you interested in?

Responses to this question were somewhat varied based upon the interest of the faculty member. Various support suggested included having one resource person available to work with faculty individually, attending group workshops, coordinating a meeting with fellow faculty members just to share ideas, and providing time for faculty to explore and develop activities.

Conclusions and Future Directions

Most educators are increasingly becoming aware of the need to include more technological applications into instruction. Infusion of technology in the preservice education of teachers is rapidly becoming a concern for teacher educators. What are the barriers to implementation? Why are some teacher educators struggling to include technology into existing courses? What types of assistance do teacher educators need in order to begin implementation? This task group attempted to provide an avenue for teacher educators to begin a successful journey in the implementation of technology as it applies to their specific roles. This avenue was the development of a Web Site that would provide resourceful information for faculty to explore the integration of technology. The results from this study indicated that this form of support was not successful in the fashion that it was presented or how it was made available to faculty.

Cooper and Bull (1997, pp. 103-105) suggested eight guidelines for reaching the goals of infusing technology into teacher education.

1. Develop a vision and a technology plan.
2. Support local schools' efforts and learn together.
3. Create a school of education culture that fosters exploration and a fearlessness about technology.
4. Provide incentives for people to use technology.
5. To encourage sharing among faculty members, provide them with free software that you want to encourage people to use.
6. Support your "product champions," the people who are pushing the envelope and staying ahead of the curve.
7. Involve people and invite all to participate and to shape the technology agenda.
8. Allow a sufficient gestation period before expecting results.

With these suggested guidelines and information gathered from this study, we can begin to make more progress toward infusing technology into the teacher education program. The web site created for faculty can still be an effective resource for faculty if offered in a more attractive fashion. Cooper and Bull (1997, p.104) explained in connection with the number three guideline above, that "faculty leaders need to create a curiosity-driven culture."

As suggested by the interview participants in regards to support, many were interested in simply sharing ideas among faculty. A recent study conducted by Parker (1997, pp.113) of university faculties' use of technology, he indicated that, "the most promising result...has been the realization by this faculty that many of their colleagues have special knowledge of various aspects of technology and that they can learn much from each other."

The results from this study demonstrated that this elementary education program is making successful progress despite the slow integration and involvement among all faculty. Low response to the web site created for faculty signaled the wrong message to the task group regarding the progress of technology inclusions. The written surveys and interviews indicated that a large portion of the elementary education faculty were interested and involved in integrating technology and had been making progress towards this integration for some time. The web site will be an additional, useful resource, however, the task group will need to provide a "spark of interest" or intriguing proposition for faculty to explore and discover its potential.

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How Do We Get From Here to There? Reports From a Teacher Education Program Learning How to Implement Technology

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Abstract: The purpose of this paper is to examine one institution's process of working through all of the necesary decisions as it prepares to implement technology as a strand into a new undergraduate teacher preparation program. In this way, this case study will provide insights and guidelines which may help other programs begin to examine the key questions for dealing with the challenges and opportunities of implementing technology throughout a program. The researcher's guidelines will be based upon data from a year's worth of program development. Other papers and presentations in the past have demonstrated the necessity and effectiveness of incorporating technology into the teacher education curriculum. This paper and presentation will go on to the next step and discuss how to develop a program focused on technology based goals with all the challenges and opportunities that come with this process.

Introduction

It is clear to all teacher educators that prospective teachers need to become prepared to implement technology into their classroom practices and teaching. Teacher education programs today are wrestling with the appropriate ways to deliver technology instruction to its students. With students coming to institutions of higher education prepared at a variety of levels of technological ability, it is difficult to determine what the key concepts and skills should be. Additionally, it is complicated to determine the best ways to deliver technology "content" once it has been determined. The amount of time available to accomplish technology training during class often does not match the time needed. Finally, the development of faculty in implementing technology into their teaching needs to be considered. How does a teacher education program efficiently and effectively begin to integrate educational technology?

Description of the Process

The researcher served as a coordinator of a new undergraduate teacher education program at a large, state institution. Technology education was a key strand in the program which needed to be developed. As part of the development an Ad Hoc Committee was convened which included faculty from the Teacher Education Department, the College of Arts and Sciences, the School of Technology, and three local Professional Development School Sites. This committee's work included: identifying key technology learning of prospective teachers in the program, identifying the method for delivering the technology training, identifying the methods for assessing students for the knowledge base, and identifying ways that this new knowledge could be extended into the Professional Development School sites. It became clear from the committee's work that technology skills needed to be embedded into the program using a building block model. But, the difficult question to be answered was how to incorporate technology into a variety of classes and how to educate faculty teaching these classes to incorporate more and more sophisticated skills into their teaching and assignments.

Concurrently with this Ad Hoc Committee the researcher served on the College of Education and Human Development's Technology Committee. The goals of this committee were to 1) determine faculty and staff needs, 2) set standards for technology skills and use, 3) determine software and hardware implications of more intense technology implementation and 4) support faculty implementation of technology into their coursework and teaching.

Clearer to this committee, was the immense task of getting hardware and software updates so that faculty and staff could implement technology. In addition, the apparent lack of interest by some faculty to update their technological skills was a roadblock to consider. Providing time and support for faculty working to implement technology more in depth into their teaching became an issue to consider. This case study will detail the process of making key decisions as the school worked towards technology literacy.

Identifying the Skills

Interesting enough, both of the committees described in this case study began their work by identifying skills that future educators needed to have upon entrance into its' programs. Members of each group felt strongly that students should be coming to their college courses with a set of pre-determined technological knowledge and skills. The work of the College of Education Technology Committee was sent to each department for review and comments. So, the Ad Hoc committee used the work of the School of Education Technology Committee to inform its' decisions. Below is a description of the recommended minimal entry requirements:

1. Demonstrate skills using e-mail communication tools

Attachments	Cut & paste from document
Nicknames	Utilizing a listserv
Signature	Organizing messages
Sending	Netiquette
Replying	Forwarding messages

2. Demonstrate knowledge of and skills in using library databases
3. Verify skill in using remote access to university (if applicable)
4. Demonstrate skills in using word processing productivity tools: cut & paste, spell check, printing, formatting, editing, backing up work
5. Operate a computer a system to successfully use software
6. Demonstrate an ability to access and use the World Wide Web

These recommendations represent the skills that students should have upon entry into any program in the College of Education and Human Development. There was much discussion in both committee meetings about whether to make these entry requirements. Members of both committees agreed that students needed to have these skills early on in any program in order to complete necessary coursework successfully and efficiently. Once these skills were identified and agreed upon, the committee had to decide how to assess if incoming students could demonstrate these skills.

Assessing Students for Minimal Technology Skills

The process of assessing students for the recommended entry requirements will take a number of forms. It was determined that students admitted into graduate programs in the College of Education and Human Development will self-select into one of the following orientation sessions that will be held prior to the first semester in the program:

- Novice orientation & assessment - for those that need assistance in learning and demonstrating competency in the minimal entry requirements
- Advanced orientation & assessment - for those that need little or no assistance in demonstrating competency in the minimal entry requirements
- Non-matriculated students will be given this checklist of minimal entry requirements. They will also be required to demonstrate their ability to meet these entry requirements even though they have not applied or been admitted into a graduate program.

Staff from the Computer Services Center will conduct the training and evaluation during one day orientation sessions held on campus. Alternatives are in the process of development for students who cannot attend orientation sessions but need to demonstrate their technological skills.

Faculty in the undergraduate teacher education program did not feel as confident that all students coming into the program would be able to demonstrate or learn these skills in a one day orientation session. The Ad Hoc committee for the undergraduate teacher education program chose, instead to incorporate authentic tasks and assessment of these basic skills during the first semester of the program. In this way, students could learn the basic technology skills as they are completing course requirements during the first semester. It is possible to organize it this way because of the required seminar in the program each semester. The seminar is designed specifically for the program and is controlled specifically by the Teacher Education Department. This makes it a bit easier to ensure consistency from year to year even if more than one faculty member from the department teaches the seminar course. The following are representative of the types of assessment tasks that students will complete during the first semester:

1. Word process a paper demonstrating an ability to: cut & paste, spell check, printing, formatting, editing, backing up work by turning in multiple drafts on paper and disk.
2. Participate on a class listserv requiring students to: send & reply, use a signature, send an attachment, use appropriate netiquette, forward a message, post the URL from a website, organize messages received, and cut & paste a document.
3. Complete a review of an educational article which requires students to use ERIC to find at least 5 articles on a topic in education of interest to you. Students must: print out the ERIC search completed, select one article from the list and read it carefully, summarize the article highlighting the major points, and offer a personal reaction to the article
4. Review 3 pieces of educational software

These authentic tasks require the students to demonstrate their ability to meet the minimal entry requirements recommended by the college level committee. In order to help students complete these tasks, support from the Computer Services Center will be made available through university offered workshops as well as computer lab support personnel.

For the first semester of the program, technology sessions have been integrated into the seminar course. While this strategy worked well, it has become apparent that this approach takes time away from course instructional time. The proposed approach of creating assignments which require student to learn minimal technology skills will allow instructors in the seminar to be relieved of taking instructional time to teach technology skills. In addition, it has become apparent that some, if not many of the students were already able to demonstrate their ability to do many of these skills. And, since the university provides a strong support system of workshops and computer lab personnel, the more efficient approach seems to be to rely on these resources to meet our goals.

Integrating Exit Technology Skills into Programs

The more complicated task of both committees has been to identify technology skills that educators need to have upon exiting programs in the college. And, even more complicated and strained have been the conversations about how to integrate these skills into course within programs.

The college level technology committee has developed a tentative list of exit skills students should have when they complete a program:

1. Demonstrate an ability to load a new program (cd-rom)
2. Using help functions and strategies for troubleshooting
3. Having skills across computer platforms
4. Demonstrate an ability to use multi-media technology i.e. effective Powerpoint presentation
5. Create and use spreadsheet databases
6. Search a variety of literature databases
7. Use electronic gradebook (if applicable)

It seems that generating this list has been a bit more complicated by the fact that faculty have different ideas about what educators need to be able to do in order to use technology for their professional responsibilities. The Ad Hoc Committee has relied upon NCATE standards to help guide their work as well as the recommendations that have come from the college level committee. Upon approval of the new undergraduate teacher preparation program, an intended

focus of the technology strand was developed. The following chart and description from the program document represents this focus and serves as a guide for technology strand development:

Essential Questions Concepts Performances Contexts
How have/do humans use technology to improve:
- o survival; comfort;
- o communications;
- o access, storage, and manipulation of info;
- o learning (esp. K-8).

What are the implications of humans' use of tech. for educating citizens in a democratic society? - definition of technology ;
- the role of technology ed. ;
- types of technology;
- development of technology, uses of technology;
- costs of technology;
- role of educ. technology ;
- principles guiding the design and use of technology to promote learning.

Analyze a situation in terms of the positive and negative implications of technology.
Analyze technology projects for math/science concepts.
Use technologies as a research and communication tool.
Use technology to enhance teaching/learning.
Use technology with students in appropriate ways. Use technology to perform academic tasks,
(e.g., Pact Boat Building Project; examining archeological artifacts).
Use technology in communication with Partner schools.
Tutoring elem. ed. students in their use of technology.

Figure 1 Goals indicating the focus of the technology strand in the TEAMS Program.

These guiding principles serve as the basis for decision making in the Ad Hoc Committee. It is clear from this chart that the new teacher preparation program is approaching technology in its broadest sense and is not limited to the use of educational technology. Students in this program will have to demonstrate their ability to use educational technology but will also have to be able to incorporate the use of many technologies into the curriculum and their teaching. So, the committee agreed that this "teaching the skills of using educational technology" and becoming "technologically literate" would happen concurrently. Students in the program will be exposed to and reflect upon the impact of technology in our lives, understand the role of technology in our society and schools, and learn the principles that guide design and use of technology to promote learning.

While this list of intended program outcomes in technology is still under discussion at this time, the much more interesting conversations have been about who takes responsibility for implementing these skills into their courses. A number of issues have arisen. First, faculty have expressed concern about their ability to teach these skills and incorporate into their coursework when they feel inadequately prepared to do this. The college level technology committee is addressing the issue of faculty development to alleviate this concern. There has been conversation of hiring a faculty member with responsibility of supporting technology development for faculty; although this is just at the conversation stage. Faculty from the Department of Technology will work with faculty in the Teacher Education Department to deliver the curriculum agreed upon for the new teacher education program. Second, faculty have expressed concern about being "told what and how to" do things in their courses. College faculty value their academic freedom and are always concerned when they feel this is being jeopardized. Third, faculty have expressed concern about the lack of "up to date" equipment they use to do their work. If faculty do not have the hardware and software to support these requirements it makes it difficult to expect that they participate in the implementation in their courses.

It seems that responding to the concerns of faculty about implementing technology throughout a program need to be addressed before it is attempted. To do otherwise would ensure failure. As each of the committees do their work, it becomes apparent why the choice of many teacher preparation programs is to develop separate courses which specifically address technology skills.

What Have we Learned?

We still have much work to do. The major lesson that we have learned is that implementing technology throughout programs is linked to many other decisions that need to be made at the same time: hardware/software updates, personnel decisions, course content, teaching loads, technology resources within the university, and faculty development. We do know that we cannot just ask faculty to add technology as a component to their courses without support. We also realize the importance of revisiting the list of recommended entrance and exit requirements we have identified. Over time, these skills will change and so will our expectations. It has been key for us to include a variety of individuals with differing levels of technology expertise into our discussions as we set expectations and develop ways to implement technology.

Strategies to Reduce Stress - Instructors New to Technology-Mediated Instruction -

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Abstract: This paper is a report on the current findings of a study being conducted through Human Resources Development Canada (Office of Learning Technologies) and the University of Alberta. Since the study began in 1997, researchers have used personal interviews, focus groups and questionnaires to gather data for this action research project. The project explores the role of the instructor and new and different approaches and strategies used to provide technology-mediated teaching and learning experiences. A theme emerging from the study indicates a need for strategies to reduce stress for new instructors working in a team environment--instructors who are learning to plan, build and implement courses using technology-mediated instruction. A number of strategies are discussed including matrixes to plan how an array of technologies can be integrated with the learning activities, samples of new and proven instructional/learning strategies that have been successfully used with each technology; information and templates to plan for interaction and lead technology-mediated asynchronous or synchronous discussions; examples of evaluation techniques; analysis of courses in progress on web sites; and a guide for a team building partnering process: These strategies, in the form of practical tools, are recommended to reduce stress when new instructors are introduced to technology-mediated instruction

Background

As educators become more adept at using technologies, and as adult learners gain greater access to media and electronic forms of communication, it becomes increasingly possible to offer courses independent of time and place. To maximize the unique features of technologies and provide quality teaching and learning at a distance, teachers need new and different approaches and strategies (Bates, 1995).

Systems Approach

Instructors using a mixture of technologies such as web-based learning, computer conferencing and audio and video conferencing, rely on the contributions from specialists for design, development, delivery and continuous evaluation. Specialists who are brought together for the course might include, but are not limited to content experts, facilitators, curriculum designers, technicians, information system specialists, researchers, mentors, program coordinators, administrators, learners and off-site personnel. Moore (1993), supporting a systems view, challenges instructors to move from perceiving instruction as individual work to seeing it as team work with "specialists--media specialists, knowledge specialists, instructional design specialists, and learning specialists" (p. 4).

Need for Study

When teachers move from autonomy and control of the course to using a collaborative structure, and from a teaching centered to a learner centered system a skill gap develops. This skill gap occurs during course development and delivery and becomes apparent for problem solving activities, group dynamics, and communication issues (Thach and Murphy, 1994). Teaching in traditional courses without technologies and teaching using technologies in learning-at-a-distance courses are on opposite ends of a continuum. To make the transition from the traditional to the systems view using multiple technologies, teachers need the opportunity to learn from the experience of others. Teachers need strategies and tools to reduce the stress that occurs when they are confronted with the challenge of using technologies to provide quality teaching and learning at a distance.

The Study

In order to explore the complexity and rapid evolution in the fields related to technology-mediated learning, Human Resources Development Canada (Office of Learning Technologies) and the University of Alberta initiated a two year action research project in 1997. By design, the project recognizes the University of Alberta's key role in providing innovative learning opportunities through the use of technologies in adult and higher education programs. The action research project is unique and valued because it not only focuses on the instructors using technology-mediated instruction, but it also focuses on the learners who are distance education instructors themselves. Since 1997, researchers have used personal interviews, focus groups and questionnaires to gather data to explore the role of the instructor and the new and different approaches and strategies used.

Findings

A theme emerging from the study indicates a need for strategies to reduce stress for new instructors working in a team environment--instructors who are learning to plan, build and implement courses using technology-mediated instruction. Interviews before the course were conducted with instructors or content experts who needed assistance from specialists with the technologies. The instructors' comments suggest that in the beginning they were apprehensive about learning new teaching strategies and modifying typical learning activities, resources and evaluation techniques for use with the technologies. They were also hesitant about their technical skills. Post-interview comments suggest that to reduce their feelings of anxiety in the beginning and throughout the course; the instructors need the following: training with the technologies before and during the course; an overview of how the technologies can be used to integrate activities and how they can be scheduled; examples of successful learning activities used with each technology; a closer estimate of extra time needed for development, delivery and evaluation; assistance in developing and maintaining on-line interaction; and a strong support system. Instructors also indicated that when working in a collaborative

environment with specialists, new instructors need to develop a partnership between the administration and the development/delivery team. The teams need to establish a shared vision or common goals, implement strategies for effective communication, and set up problem-solving procedures.

Comments from learners interviewed in the study (who are distance educators themselves) support the need for instructors to feel confident with the technologies. The learners suggest that the success of learning on-line, developing interaction and fostering feedback loops through the technologies hinged on how comfortable the instructors were with the technologies.

A profile of skills and attributes for instructors developing and implementing technology-mediated distance education was developed for the study by a group of colleagues experienced in distance education. In the technology area, the profile indicates the need for instructors to work in a team environment to develop curriculum and learning activities to merge with the technologies such as web-based learning, computer medicated conferencing, audio conferencing and video conferences, as well as with on-line resources. The profile recognizes the instructors' need to have basic keyboarding skills, to be computer literate, to be able to facilitate on-line discussions and manage their time in an asynchronous environment, and to facilitate audio and video conferencing.

Discussion

O'Bannon (1998) supports these findings that instructors need to obtain resources, support, and training to develop and implement technology-mediated distance education courses. To develop and deliver the course using a mixture of technologies, new instructors would benefit from a framework to plan, develop and implement instructional strategies with appropriate technologies; promote interaction; lead technology-mediated activities and use the technologies for evaluation.

Strategies recommended here include representative questions for instructors to consider; matrixes to plan how learning activities can be integrated with the technologies; samples of new and proven instructional/learning strategies such as case studies, debate, role play, small group work, or demonstrations that have been successfully used with the technologies; information sheets and templates on how to plan for interaction and lead technology-mediated asynchronous and synchronous discussions; examples of evaluation techniques; demonstrations of courses in progress such as web based learning sites; and a guide for a team building partnering process: These strategies, in the form of practical tools, are recommended to reduce stress when new instructors are introduced to technology-mediated instruction.

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Faculty Uses of Technology in Teacher Education

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Abstract: This study examined how faculty integrate technology in their classroom teaching, what factors affect the use of technology, and how faculty perceives technology for their teaching. The study used an interview method to investigate the faculty uses of technology in the teacher education program of a northeastern university. The interview questions consisted of three major categories: 1) teacher educators' background, 2) current uses of technology, and 3) problems in using technology. Findings indicated that most faculty expressed positive attitudes toward the use of technology in their teaching, and were extensively using technologies as delivery tools and instructional tools for learning activities. However, classroom environment change and additional technical supports were still needed to facilitate creative learning with technology.

Technology encourages active participation in learning, promotes exploration of various methods of problem solving, and facilitates students' ability to formulate concepts. Although the impact of computers on elementary and secondary education continues to grow rapidly, higher education faculty continue to rely on more traditional methods for delivering instruction (Spotts & Bowman, 1995).

Albright and Graf (1992) argue that most students in colleges and universities have grown up with technology and often are more technically literate than many of their professors. They emphasize the transition from traditional methods to modern technologies in the higher education classrooms. A survey by Spotts & Bowman (1995) on instructional technologies in higher education reported that faculty who had the highest levels of knowledge and experience with technology exhibited a higher rate in faculty members' frequency of use of technology in teaching.

To prepare future teachers to teach with technology, Wetzel (1992) recommends a model of professors who use the computer in their courses and who require their students to do so in the design of integrated units and field experiences. White (1995) suggests modeling that includes demonstrations by the instructor, integration of technology into classroom activities and application of technology into class projects.

The Purpose of Study

In an effort to infuse technology, the Cleveland State University teacher education program established a Technology Committee with the charge of developing a technology plan for the College of Education in 1995. Each faculty has redesigned semester syllabi to incorporate technology objectives into their courses. In order to find a distribution pattern of technology uses throughout the courses in the teacher education program, a technology survey was conducted in Spring 1998. The survey indicated that many faculty were using technology in a variety of ways. There were several categories that determine faculty use of technology into their classroom activities. In many courses, technology was used for writing, database

searching, research analysis, and communication. However, the survey indicated the big picture of the current uses of technology, while it couldn't answer the two questions:

1) Why faculty were using technology in the classroom teaching?
2) How faculty were using technology in their instruction?

In order to find out these answers, a follow-up study was conducted with full-time faculty in the teacher education program to examine the factors that affect integration of technology in teacher preparation. To investigate the impact of these factors, semi-structured interviews were conducted with 14 faculty in the teacher education program. The interview questions consisted of three major categories: 1) faculty background, 2) the current uses of technology, and 3) problems in using technology.

Method

The participants for this study consisted of teacher educators distributed in various subject areas: educational research, educational technology, educational psychology, math/science education, instructional leadership, and urban studies. Their teaching experiences were diverse from one year to fourteen years. The participants were randomly selected from among the faculty of the teacher education program. The interviews were arranged at a convenient time for the participants and interview time ranged from 30-45 minutes. The researchers asked faculty what they were using in the classroom, how they were using technology in the curriculum, how their students were doing with technology in their activities, and what they would like to use in their classroom. The interview data was recorded on audio tapes and the tapes were erased following transcription.

The interview questions consisted of three major categories:

1. The teacher educator's background section contained information about the teaching experience, teaching area, teaching philosophy/approach, technology experience, and belief/perception of technology education.
2. The current uses of technology section consisted of questions about the major teaching material/resources, level of integrating technology, and availability of technology for instruction.
3. The problems in using technology section included issues about the problems in using technology during the instruction, supports for integration of technology, and other obstacles in using technology in the classroom teaching.

Results

In the present study, the interviews were conducted with 14 faculty in the teacher education program. One interview was dropped due to technical problems with the audio. Therefore, only 13 interviews were transcribed and used for data analysis. This study reported the findings by qualitative data description method instead of quantitative data analysis because the focus of study was on examining factors that affect the depth of technology use. Findings indicated that most faculty expressed a positive attitude toward using technology in their teaching, and that they realized the benefits of technology use in their classroom teaching as well as in the preparation of instruction. Over all, they provided valuable input on the possibilities for integrating technology into teacher education program.

Teacher Educators' Background

29 % of the participants had a strong background in technology, 36 % of them had moderate experiences with technology, and the remaining participants had limited experience in technology. More than 62% of the participants have consistently used video technology in their classroom instruction. Most faculty were extensively using technologies as delivery tools and instructional tools to support teaching and learning. The uses of technology in instruction were categorized into five major activities: classroom assignment, information searching, communications, data analysis, and presentations.

All participants with the exception of one, share common characteristics with respect to constructivist pedagogical belief and practices.

- "...asking questions to help them accomplish what they can without having a particular goal that I want them to get to; rather helping them discover their own goal."
- "I don't just lecture: group learning, physical exercises, technology, readings, written work and things like that. I try to incorporate as many different methodologies as possible so students see different ways of teaching."
- "we are not here to just give information, but they should be able to use it to make their lives and other peoples' lives better."
- "I think it is very important for me to model for my students the things that I describe to them. If I tell them that electronic mail is an important tool they should be able to see me using electronic mail and clearly evaluate from what I do."

Some participants mentioned about their positive experience with technology and benefits of technology in their classroom teaching.

- "Students were actually surprising me with some of the things they actually done. So I was now learning from them. Rather than them learning from me."
- "I've asked students when I've had large sizes of 90 students if the video discs are helpful. I got a lot of good feedback from the students."
- "When you can use more advanced technology, you can do the little things that can hold attention even to something that's dry material. You can present a scenario and then move them through it step by step. It just really pulls you in."

Current Uses of Technology

The majority of participants indicated that they most often used of video, word processing, web searching, e-mail, and projectors in their classroom teaching. Word-processing, e-mail, web searching and statistic packages were being used extensively for the assignment, communications, and data analysis, while other instructional technologies such as interactive video, or multimedia design had remained very limited. The current uses of technology by the participants in the classroom are listed below.

- Classroom videos especially in non computer classes
- Overhead projector as a basic delivery material
- Word processing for classroom assignment
- Presentations with either Power Point or Claris Works
- CD materials as information resources
- E-mail with small/large groups of students
- Retrieving information for their own needs from the web
- Drawing programs to represent with the use of discussion
- Computer video projector to demonstrate instruction
- Statistical packages like SPSS or OSS to analyze data
- Excel to organize and to manipulate data
- Class mailing list that are set up for use by students in a class.
- Virtual environments such as an electronic group tour on web sites
- Web page design for student projects

Problems in Using Technology

More than 85 % of participants were interested in using technology in their teaching practices. Most were still using minimal technologies such as video and overhead projectors instead of computers or other

technologies. The main problems participants had concerning technology use were: a lack of proper equipment, lack of support, lack of time, and lack of knowledge.

- "The technology was so sluggish that the students got very frustrated with it."
- "I might try PowerPoint later, but that's not really in my classroom."
- "Using technology within the class means that things go wrong much more frequently and the amount of advanced planning required on my part is much larger."
- "You need technical support for when things aren't going right; you don't know what you don't know."

Two participants who teach science education and educational research, expressed their negative effects about using technology in their classroom teaching.

- "I don't use it very much because I think especially in science I'm afraid that they will be mired in the technology. ... but I've used it a dozen times already this morning."
- "I like the Internet but I find that students aren't to the point yet to distinguish what's scholarly and what's not. I did one assignment and I got papers from a Psych 101 class."

In addition, one participant specializing in educational technology suggested the ways to increase the uses of technology in the teacher education program.

> "Human beings have a tendency to stick with what they know, and that's what a lot of our colleagues are doing. The faculty members who are reluctant to try technology are often the faculty members who are reluctant to try other new ways of conducting their classes that they have very little experience with. We need to do is provide modeling. ...We need for them to be able to look at colleagues and say 'oh, you are trying something new, how's that working out'... and not only model it but make it easier for our colleagues to try it."

Interest in Using Technology

Participants' interests in using technology in their future classes were categorized in three different areas: distance learning, accessibility of equipment, and various learning activities with technology.

- "I'm going to move toward using more distance learning in the course, web page design and use."
- " One of my interests is distance learning because now I'm teaching a long way and that was quite a long drive, so that could be done via satellite."
- "some support for doing networking in those types of connections"
- "more portable and easier to use"
- " Another thing that might be useful is video conferencing. Because I see video conferences advertised once in a while in the chronicle of higher education."
- "For my classroom teaching I would like to have nonlinear editing equipment it would be nice to have sophisticated digital equipment for both producing the raw video footage as well as editing that footage and using it in class."
- "I'd like to learn more about setting up a web page for a couple of reasons. A web page would be a supplement to my course; students are looking for what the different standards are in science education they could go from our class web page to there."

Conclusions

To prepare an effective teacher for tomorrow's classroom, teacher education programs across the country have been faced with a challenge of integrating technology into classrooms, lecture halls and laboratories. In order to answer these challenges faculty must establish an ability to integrate modern technology with instruction. One faculty emphasized that with technology "educators can accomplish more of what they

want to accomplish. That's when they become self motivated to learn more. But that's when they begin to model it for their students. That's when they begin to look for ways of incorporating it into their classrooms."

This study indicated that the majority of faculty had strong interests in using technology and a positive attitude toward using technology in their classroom instruction. Although they were using technology in a limited scope due to a lack of equipment, lack of support, and time pressure in the class, they were consistently using technology to prepare their instructional material, information searching, and research. Their personal experience with technology promises a bright future in integrating technology into the curriculum. We believe that the uses of technology to perform their professional work will be expanded and transferred in the classroom instruction.

Even though major factors affecting technology use in teacher education programs were indicated in several categories such as equipment, knowledge of technology, skill with technology, and support in using technology, technologies were not used properly for other reasons. One faculty member mentioned that "I would like to try to use PowerPoint or something in the future, but I tend not to use the board or overheads. The class is basically seminar style. I find when I make notes on the board, students think that's it, copy those down, and just focus on that. If I talk about something else, they don't focus on that so that's why I avoid overheads." Technology has the capability of providing more effective learning environments. Perhaps in some areas we can restore and improve teaching and learning by providing technical support and specialized instruments for instruction. In addition, colleges and universities need to recognize, to support, and to reward exemplary faculty who are making extra efforts in using technology.

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Teaching the Teachers: Preparing Adjunct Teachers to use Computers in the Classroom

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Abstract: All freshmen entering Seton Hall University in Fall 1998 received laptop computers as part of their tuition, and were guaranteed that two or more classes would make "extensive use" of the computers. Because a basic English Composition class is required for all freshmen, we focused our efforts on training faculty in this department. The English Composition class is largely taught by adjunct instructors, who are on campus only to teach their classes. Many of the adjuncts are not identified until just prior to the start of term, and have very limited prior experience using computers. Despite these challenges, all English classes have successfully used computers in teaching this fall, in many cases quite extensively. This paper describes how Seton Hall successfully met the challenge of preparing adjunct teachers to use computers in the classroom. The concepts of computer attitude and resistance are described, as well as techniques designed to increase faculty adoption of computers in the classroom.

Introduction

All Freshmen entering Seton Hall University in the fall of 1998 received notebook computers as part of their tuition, in the first full rollout of Seton Hall's Mobile Computing Initiative. Students were guaranteed that two or more of their classes would make extensive use of the computers as part of the basic curriculum. Because all freshmen are required to take a core English class, the English department was chosen to be a main focus of the first year's faculty training efforts. Faculty training for the English department presented several challenges, however. Many of the nearly 100 sections of English composition are taught by adjunct instructors. The adjuncts are on campus only to teach their classes, and in many cases are not identified until the end of the summer. Because of Seton Hall's unusually large fall 1998 freshman class, many new adjuncts were hired this year. While the adjunct faculty could be encouraged to attend training seminars, attendance could not be enforced. Given these constraints, it was decided that training could not take more than one day. Finally, many of the adjuncts were newcomers to teaching with technology, or to computing in general. In order to meet the guarantee made to our students, we needed to ensure that the one day of training was as fruitful as possible, and that it would serve to encourage faculty to use computers in a thougtful way in their teaching.

Encouraging faculty adoption of computers in teaching is frequently discussed in terms of resistance to technological change (e.g. Jaffe 1998). The concept of resistance to technology is not unique to academia, but has been discussed in relationship to other types of organizations, as well (e.g. Ellen et al., 1991; Hill et al., 1987). Moreover, considerable research has been conducted by psychologists and human factors specialists on the concept of resistance to technological change, which can fruitfully be applied to academia. In this paper the concepts of computer attitude and computer self-efficacy are described, and an approach to training faculty to use computers which relies on prior research in these areas is presented. The training program is designed to encourage faculty adoption of computers in teaching. The work presented here is not an experimental test of this approach, but is rather a description of activities conducted at Seton Hall University to train adjunct instructors of English composition. This approach has been very successful. While many of the instructors were not experienced computer users prior to the start of our training program, this term nearly 100% of freshman English composition instructors have been making active use of computer technology both in and outside the classroom.

Description of the Training Program

The work described here was conducted by the Center for Academic Technology (CAT), an administrative unit at Seton Hall that is dedicated to assisting faculty who are adopting technology into their teaching. CAT is staffed by five full-time faculty consultants, all of whom have advanced degrees, experience in higher education, and experience in classroom teaching. Among several other roles, CAT provides computer training programs for faculty.

Our primary training concerns for the English department were that faculty would be stimulated to continue to use computers outside of training, and to use the computers in a thoughtful way in their teaching. Faculty required basic computer skills training, as well as orientation to new pedagogical strategies. To meet these goals, we examined research conducted on computer training as it affects performance and continued computer adoption. Across many studies and a variety of domains, self-efficacy beliefs have been found to be a useful predictor of continued computer use (e.g. Gist et al. 1989, Hill et al. 1987, Kelley et al. 1998). Computer self-efficacy can be defined as the belief that one will be successful when interacting with computers. Computer self-efficacy can be considered to be just one of several dimensions contributing to the concept of attitude toward computers. In addition to self-efficacy beliefs, computer attitude encompasses the dimensions of feelings of comfort toward computers (or the reverse, also sometimes called computer anxiety or technophobia), beliefs in the utility of computers, the belief that computers are dehumanizing, and interest in computers (e.g. Jay and Willis, 1992). It has been suggested that attitude toward computers predicts future interactions with computers (Kelley & Charness 1995, Kelley et al. 1998, Torkzadeh & Angelo 1992). Furthermore, across many studies it has also been found that brief, successful computer training can serve to improve attitudes toward computers (e.g. Morrell et al. 1996, Gist et al. 1989).

On the contrary, positive attitudes toward computers do not generally predict success at skills training. To address the need for providing successful skills training for the adjunct instructors, we also considered some basic principles of human factors psychology. Human factors is the study of how people interact with their environments, and the effect of mismatches between people and their environments. When mismatches exist, two approaches are possible: Alter the environment to make it easier to navigate, or alter the person through training. In other words, the need for training is minimized when an environment is engineered to be uncomplicated and easy to use.

Based on this basic principle of human factors psychology, we decided that the best way to approach the English composition classes would be to create a set of computer resources for the adjunct instructors, and make these resources as easy to use as possible. The first step required was to find a software product suitable to the needs of an English composition class, and encourage the use of this product for all classes. Focusing on a single product or a small range or products ensures that faculty will have access to support from peers using the same techniques, and also reduces training burden considerably. A team of full-time faculty in the English department examined a range of products available to them and determined that Lotus LearningSpace provided the most suitable solution to their needs. LearningSpace is courseware, or software designed to deliver entire virtual courses over the World Wide Web. LearningSpace works as an add-on to Lotus Notes, which is the e-mail system currently in use at Seton Hall. Therefore the LearningSpace development environment is quite familiar to full-time Seton Hall faculty. While adjuncts had less experience with Notes, they had easy access to colleagues who could provide assistance.

While LearningSpace was considered a reasonable solution to the needs of the English department, it is also a flexible and complex product. In software training, there is often a tradeoff in the flexibility of a product and simplicity of use. Flexibility and complexity can translate into difficulty in learning to use the product. However, the complexity is most apparent to those developing a course. Therefore, CAT and the English department decided that it would be desirable for a small team of experienced English instructors to develop LearningSpace templates for use by the adjunct instructors. Once the courses were developed, it was reasoned, the learning burden for the adjuncts would be relatively small.

The second step was therefore to design two complete English courses in LearningSpace. These courses could then be copied and used by each of the adjunct instructors. The two templates correspond to the two levels of freshman English, the basic composition class and a remedial class. Several full-time

English faculty were provided a stipend to develop these resources over the summer. It should be made clsear that the templates are not simply skeleton courses, but are a complete set of resources for instructors in the two classes to use in their teaching. While these courses could be altered by individual instructors, they could also be used "as is" for those with limited computer skills.

The third step was to design a one-day training workship on using the core syllabi at the end of the summer. This workshop emphasized hands-on work with the core syllabi. Seton Hall's faculty training programs all follow this workshop model. Throughout the computer training literature, it is consistently found that individuals learn to use computers better when trainees are engaged in meaningful work; when they are free to explore the system actively, as compared to a rote drill and practice model (e.g. Frese et al. 1988); but when sufficient structure is provided for trainees to be exposed to a wide range of software functionality (e.g. Charney et al. 1990).

Several benefits to using a complete course template became apparent during the training. First, provision of the template served to reduce the complexity of the LearningSpace development environment, as was intended. In addition, the template served as an effective model to faculty who had essentially no experience teaching with technology. By interacting as students with the core template, faculty were able to envision how they might make use of the technology in their own teaching. Prior to the training, "teaching with technology" had been an abstract concept. Through training this concept was made concrete and real. While we did not measure attitude toward computers either before or after training, self-report by many adjunct faculty members indicated that such a transformation was occurring. On post-training evaluations, faculty indicated in very concrete terms how they intended to use computers in their teaching. Mapping this transformation onto the model of computer attitude presented above, provision of a model enabled faculty to see the utility of computers. Interestingly, many of the faculty participating in the training have not gone on to use the LearningSpace templates provided for them. However, some have mentioned that the exercises done in class helped them to think through how they could use the computers effectively.

Furthermore, by providing hands-on practice with the syllabus in a supportive context, faculty self-efficacy with computers was apparently increased. Increased self-efficacy has led to continued use of the computer outside of the training. Individual adjunct faculty members have expressed to the author of this paper that prior to the training, they did not believe that they would ever be able to use computers in their teaching. After the training, beliefs in their ability to use the computers successfully were enhanced.

The fourth step in the training program concerns continued support of the English faculty. Several follow-up training sessions have been held during the course of the term to reinforce the single day training held at the end of the summer. In addition two faculty consultants are available for help and consultation on an individual basis. The follow-up sessions have primarily been attended by faculty members with weak computer skills, while consulting sessions have been requested by faculty at all levels of ability. Those with stronger skills are typically seeking to extend and enhance their application of computer technology in teaching. Faculty consultants have also been available for classroom observation and support. Classroom observations have been requested by faculty members at all levels of ability, and are typically conducted to troubleshoot minor technical glitches.

The result of this carefully planned training and support program has been a dramatic increase in the use of computers to teach English composition. Nearly 100% of English faculty are using some computer resources to help teach their classes. This increase is occurring despite the fact that computer use in the classroom is not enforced, but encouraged. The English faculty have been very enthusiastic in their adoption of the new technologies to assist their teaching, and have served as a model for other departments on campus. Focus groups held with faculty using LearningSpace during the middle of the term expressed both positive and negative consequences of using this program; however, feeling unprepared to use the program was not brought up at all. Most importantly, students are responding well to the new style of teaching. Focus groups held with students indicate that students are very pleased with the technological activities occurring in their English classes.

Conclusions

The training program developed for adjunct instructors at Seton Hall University made use of prior research on computer training, taken from the fields of cognitive, industrial /organizational, and human factors psychology. Adjunct instructors were trained to use an existing set of course resources, rather than to develop these resources on their own. Provision of the template simplified the training considerably,

leading to a greater likelihood of successful interactions with the computer during training. Successful interactions with the computer during brief training has been shown to improve computer attitudes (Gist et al., 1989; Morrell et al., 1996). Positive attitudes toward computers are also associated with computer adoption (Kelley et al. 1998). Provision of the template also served to clarify the potential uses of technology in teaching. The result has been a very successful program of technologically enhanced English classes.

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The Trek for Tenure: Hacking Your Way to Research and Publication

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Abstract: With the exception of how one can legitimately utilize current technology, the trek for tenure is well defined in many institutions. Among other things, one researches thoroughly and publishes in reputable, referred journals a specified number of articles during a five year time limit. In many institutions, publishing in an online journal is not considered as a referred journal, even if it is in fact a referred journal. Whether good or bad for the young assistant professor, there is a need for such a rigorous process in gaining tenure. Tenure is achieved because evidence indicates that the individual has, and will likely continue, to produce research that furthers the knowledge base in a given field. Active participation in institutional committees, presentations to conferences, appropriate student/ administrator evaluations, and good advising partially support this theory. However, publishing in referred journals gives much more credence to this theory. Referred publication requires dedication to conduct research in the field, scour related literature, and become aware of the most efficient methods to locate publication sources.

The actual use of current technology in achieving tenure is sometimes confined to those brave souls who ask either their Information Technology or Distance Learning departments for assistance. Technology can provide not only in-depth research in a timely manner, it can also support appropriate practice in manuscript style and publication itself. This presentation details answers and sources to some of the most frequently asked questions regarding the use of technology in the process of research and publication toward tenure.

I. Brainstorming

What is a Database?

A database is nothing more than a collection of information. There are many familiar non computerized databases that people use everyday. The telephone book is a good example as well as a recipe file.

One of the advantages of electronic databases is the flexibility in the keywords needed to find a bit of information. In a hard copy telephone book you must know the last name of the person you are searching . In an electronic database the person's first name my be used as a key for searching, as well as the street or phone number.

Another advantage of an electronic database is the amount of information available. CD -ROM databases can hold 600 megabytes of information. France has the entire country's telephone directory now available

electronically. One popular CD-ROM ,Microsoft's' Bookshelf, contains the Concise Columbia Encyclopedia, The American Heritage Dictionary, The Hammond Atlas, Roget's Electronic Thesaurus, Bartlett's Familiar Quotations, The Concise Columbia Dictionary of Quotations, and the World Almanac, complete with text graphics and multimedia elements including animation.(Newby, Stepich, Lehman, and Russell,1996)

Ease of manipulation is another advantage of electronic data. Information can be quickly made available. Any one checking on the status of a bill has experienced this phenomenon .With an electronic data base one can quickly find the answer from a central office that may cover many states, Sometimes without doing any more than giving one's own telephone number electronically at the appropriate time a voice gives you an answer.

Databases then can be of great assistance to anyone trying to gather and process information to prepare for classes, papers or presentations. To not use data bases would be a handicap in the demanding environment of universities today. Universities want people who are productive in the teaching, service and scholarly productions areas.

How does one access the databases?

Databases may be found through commercial information services . General information services include Compu-Serve, America Online, and Prodigy. For a fee that can be a flat monthly rate or an hourly rate users can get dial -up access. More specialized services such as DIALOG offer access to hundreds of commercial databases. Bibliographic information about magazine articles , full text of some newspapers and current medical reference information are available.

Some may use telnet to connect with a remote computer in a manner similar to e-mail. The chief use is to gain information from such sources as the Library of Congress catalogue and the catalogues of many university libraries.

Freenets , community resources open to the public and free of charge are accessible in this manner. The city of Cleveland Freenet is a pioneer of the community freenet concept. Only certain systems are open to this kind of connection and there are more efficient uses of your computer perhaps than via telnet.

There are several other sources to of information -usenet news groups, file transfer protocol, Gopher and the World Web.

Use net news groups are the Internet equivalent of bulletin boards. Individual can contribute comments on news articles that can be read by anyone belonging to that news group. Others can answer and discuss these reactions . Discussion topics are identified by abbreviations :comp(computers), misc (miscellaneous), sci (science), rec (recreation), and alt (alternative). The alt especially can contain material unsuitable for children.

File Transfer Protocol is the standard method of exchanging files. Like telnet this is a live connection to a remote computer. Many Internet sites support anonymous ftp. When the user is asked to identify himself ,he may gain access by using "anonymous" as a log- in id.

A software system called Archie allows users to search databases for information of interest.

Even with available databases telnetting and ftp can be daunting . Information retrieval can be made easier with a system called Gopher. This is simple menu driven system . Veronica is available to assist users to search the Gopher databases for topics of interest.

The fastest growing part of the Internet is the World Wide Web. The WWW with its access software of Mosaic and Netscape provides information on the Internet in the point and -click hypertext format that is familiar to all users. In addition with the appropriate software and a sufficient high speed connection graphics, audio and even digital video are available.

What databases are available to help?

There are so many , but here are a few.

RESOURCES	DESCRIPTION	ADDRESS
Cleveland Freenet	Cleveland freenet	freenet-in-a,cwru.edu

Educational Resources Information Center(ERIC)	ERIC databases and information	ericir.syr.edu
Info-Mac Archives	Large ftp archive site for Mac freeware and shareware	sumex-aim.stanford.edu
Library of Congress catalogue	Searchable catalogue for the Library of Congress holdings	locis.loc.gov
NCSA web server	World wide Web server of the University of Illinois	http://www.ncsa.uiuc.edu
WUARCHIVE	Washington University archives, one of largest ftp archives	wuarchive.wustl.edu

If you would like to access other databases, try http://search.ed.gov/csi/index.html, the U.S. Department of Education Cross-Indexing Project.

Once a Database is found how do you find it again ?

Perhaps the easiest way is to access the bookmark feature is by clicking on the toolbar at edit. When the word bookmark appears click on it to add this location to a list of sites you want to frequent. Be sure you are at this site and have it open before trying to make a bookmark of this site.

II. Shaping the article

If you decide to publish in a print journal, are there resources on the WWW that will show guidelines?

The online resources for publication usually contain both traditional print journal guidelines and online submission standards. Many professional journals use the Internet as a means of publishing their calls for submission. Several journals are listed on this site: http://www.morehead-st.edu/people/l.lennex/sites.htm.

To locate your particular journal, one should use a search engine. Search engines identify sources based on your query words. Several search engines, all free of charge, are http://www.yahoo.com, http://www.altavista.digital.com, http://www.excite.com, and http://www.lycos.com. Depending on the search engine, you may use boolean searches, multiple word searches, or narrow a search based on perceived engine parameters (Alta Vista provides this service which is very useful). One must keep in mind that searches often yield hundreds of results. The search engine locates web sites through their titles and the submission by the web page author. The first few results of a search will likely yield the best results. The engine tries to "paste together" one's query and the results will contain both combinations and single words.

III. Pre-Writing

There is so much information to download with research. I've heard of zips, jazzes, and superdiscs. What are they and how does one use them?

These are discs which hold large amounts of information. Zip discs, for example, hold approximately 100 regular discs amount of information. One needs an additional drive for such discs. These discs are so common today that many new machines will already have a drive built in.

Some of the information I've found on the WWW comes in a PDF format and states that I will need to download the Adobe Acrobat Reader. What is PDF? What is the Reader and how much does it cost? Is it of any use to me?

PDF is portable document format. It allows one to read properly formatted text and graphics without having the authoring program on one's computer. The reader can be downloaded for free at this address **http://www.adobe.com**.

Many of the journals now require a standard format for referencing WWW information. Where can I find an online guide to MLA and APA format?

A good resource is http://www.lehigh.edu/~inhelp/footnote/index.html. It contains style manuals for almost every area imaginable.

IV. Writing

How does one choose the most appropriate word processing package?

Appropriate packages depend on the user preference. A popular word processing package comes in the Microsoft Office Suite. It is called "Word." For the Mac, word 98 has been in use for the last year. PC versions will be likely using versions 95 (4.0), 97, and possibly 98 in the coming months. This word package allows the user to create documents with specific profiles in addition to importing spreadsheets, databases, and multimedia. The program offers an animated assistance tool under the question mark icon in the common toolbar. The assistant is able to guide you through the most complex operations of Word without ever leaving the page. The most useful feature to my teaching has been the ability to create html and hyperlinking. Web page creation can be done with a wizard. A wizard allows one to create multimedia by simply filling in the blanks. Check out the wizard in PowerPoint before doing your next "presentation." Hyperlinking allows the user to link several documents, multimedia, spreadsheets, or databases to a central location.

Other word processing packages are quite popular, being a Mac person, I have used ClarisWorks for many years. ClarisWorks offers the same basic features as Word, but does not have hyperlinking ability nor wizards to automatically create multimedia. It is much easier to manipulate page settings, text formatting, and cut and paste features than Word.

V. Sharing

I've written an article and I 'd like to get feedback from colleagues. How do you make an attachment on e- mail?

There are different servers out there to make attaching a document very easy. The newer e- mail servers will have as one of the choices at the top of the e-mail screen an icon that puts you into a framework that leads you through the process of making an attachment. Some of the older models such as the Unix-pine system will have a list of at least six steps that must be executed before an attachment is sent . There is also the added problem of sending information that is compatible with the receiving computer. The word processing format , if different can make your document unreadable. It is best to find an On the Spot Human (OSH) you can persuade to lead you through the older attachment procedures for the first or perhaps a couple of the first forays in sending an attachment.

How Do You View and Attachment?

To view and attachment in the newer versions of e-mail is simple . There will be an icon at the top of the screen for you to click on to access an attachment. If you have an older version grab a willing OSH to mentor you through the process, then find one. You may not be successful if the computer systems and or software is not compatible.

What are some tips on conferring with an editor?

Before you hire or connect with a professional editor it's recommended that you find a colleague close at hand to read your articles . Preferably an OSH to make interaction and discussion easy ,but if this is not possible try to find a key-pal to help you . One way might be is to join a list serv in your area of interest. Ask your other list serv members who would be interested in an arrangement of reciprocal review of your writing . In this manner you have some one to or even better several ones to help you improve your writing.(Zbikowski and Pan,1997).

Most campuses will have a professional editor that will edit your materials for anywhere Interaction with the audience $10 to $30 an hour (That's in my area). You need to investigate this person by asking others who have used this editor if they feel the editions have been helpful to them and the publishing process.

If an OSH editor is not available on your campus then try the listservs in your area for a professional editor or try a database in your discipline that and do a search for a professional editor. You want your final draft to be as good as you can get it before you send it to the publisher of the journal of your choice.

VI. Conclusion

What advantages, if any are there to being published on the WWW ?

In the past the publication process took from six months to a year after the study was completed . Electronic journals can cut this time by three to six months

One college scholars comments were that in the past no one published ideas. Only after much time study and research were theories published. How much better to have the faster feedback and interaction tin the earlier stages of thinking (Wittenburg,1998).

The Columbia University Press has a new publication Columbia International Affairs Online known as CIAO. Because of the subject matter CIAO offers a particularly good opportunity to experiment significantly. World events have a direct impact on discussion and from around the world conversations and seminars can immediately review predict and perhaps advise on problems and solutions (Wittenberg, 1998). David Pullinger, publisher of the electronic version of NATURE predicted that eventually only the top journals would be printed (Guernsey, 1998).

How can you find tenure information at your institution regarding the use of online publishing?

Many universities are still slow to give much credence to the electronic publication as a meritorious publication. Time will eventually take care of this problem but for now apprentice university professors should not rule out either process print or electronic journals. Many cutting edge journals in educational technology utilize print and online resources because of this issue. To locate information specific to your institution, look at the faculty or the human resources web pages. At our institution, the tenure and promotion document is called "pac-27" and can be accessed from the faculty senate web page. Be aware that individual departments may have different standards from university tenure policies. Always check the university policy thoroughly.

Use the electronic capabilities discussed in the above to search out information and to share ideas and to edit and revise using electronic journals as you go but which should result in one or perhaps two high quality pieces a year to submit to the print journals . Use one to help improve the other and to learn from hundreds perhaps thousands of colleagues you have on the Internet . Your Electronic Journal will be cutting edge. Your Print Journal submissions will be reflective, polished and more cutting edge because of your use of the technology.

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Teaching "Old Dogs, New Tricks": Stimulating the Learning of Technology Among Tenured Faculty in Schools of Education

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Abstract: Apprehension among several tenured faculty members that the recent hire in the school of education would be too aggressive in promoting the integration of technology into their courses, led the author to investigate current levels of technological integration and knowledge. Concern was shared that courses which tenured faculty over the years had settled into a pattern of teaching, according to "the old ways", would be disrupted was slowly resolved.

As the author was finishing his dissertation in Instructional Technology under Dr. Charles Dickens of Tennessee State University, Nashville, he was invited to interview at a small, religiously-affiliated university. During the interview, a demonstration was arranged of the various technology components that had been integrated into his dissertation research. After the demonstration, several tenured faculty members expressed delight in having the technology available, as well as someone who was knowledgeable, but there was apprehension as to this "new kid's" status in the school of education. There was concern that he would be too aggressive in promoting the integration of technology into their courses; courses which they over the years had settled into a pattern of teaching according to "the old ways".

The NCATE accrediting team in late 1997 had encouraged more and varied integration of educational technology into the school of education's courses and into the actual teaching of the courses by the established faculty. It therefore became the task of the author to allay the fears and apprehensions of the current faculty, while encouraging them to experience a variety of current technology in a non-threatening environment.

As conversations developed toward the beginning of the fall 1998 term, various instructors and professors asked the author for help with technology diffusion into their particular fall courses. What became immediately apparent was that most were aware of MS PowerPoint as a presentation tool, but had little practical experience using it themselves. While some had a notion of what was actually involved in creating a slideshow, fewer had personally accomplished the task of creating one themselves and almost no one was able to teach the application to their students in the classroom. This lack of expertise on their part led to also having little knowledge of how to the evaluate the students' work in this area.

One of the author's first tasks was to do a needs assessment for all of the fall courses offered by the school of education. With the help of the Dean, each of the courses was identified and the various technology components were labeled and categorized. With obvious regularity, MS PowerPoint seemed to be the almost exclusive technology tool used. The author, because of his extensive background in Instructional Technology at Tennessee State University, Nashville, offered a variety of suggestions of alternative technology components. Further, he offered the expertise and the computer lab time necessary to teach these new technologies to the school of education students enrolled in fall classes, both undergraduate and graduate. And to instruct the faculty in the proper evaluation of these new technology components. These suggestions were readily accepted by the tenured faculty members!

As the various classes have been instructed by the author in the chosen technology component, the response from the faculty has been encouraging. A wide variety of student technology projects have been accomplished and hosted on the web <http://teachfhu.edu/technology/>; the students are becoming more comfortable with the technology; and the teachers are seeing the tremendous benefit to their courses of the technology-based projects. One particularly painful realization for some of the undergraduates was that quality web-based projects do not take shape over night. Since many of the technology components are

either housed or soon will be housed on the school of education's web server, the author held these projects to a higher standard than many undergraduates were accustomed to complying with which produced some agonizing moments as projects were returned for revision. The site is located online at http://teach.fhu.edu/technology/ .

All of the interactive web pages produced by the EDU 330 students were formerly part of their practicum experiences in the local schools. Several of their cooperating teachers have acknowledged their fine work and the usefulness of their projects for themselves and other teachers in the local public schools.

As the semester came to a close, some of the tenured faculty have acknowledged their lack of familiarity with the technology and have asked for private tutorials from the author. These are planned for early in January. There is wide-spread belief among the school of education faculty that the next NCATE team (Nov. 99) will be pleased with our progress of "Teaching 'Old Dogs, New Tricks'!"

Classroom Impacts of a Masters Program in Instructional Technology

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Abstract: This paper will examine the impact of a masters program in instructional technology on the classroom practices of teachers. This program emphasizes the integration of technology into the curriculum and the use of technology to drive education reform, rather than simply focusing on technology skills. Current research is beginning to indicate that programs such as this may be successful in transforming traditional, teacher-centered classrooms to more constructivist, student-centered environments. Case study and exit survey results are the main data sources for this study. Early findings support early conclusions that we are having a transformational effect with our cohort teachers, and are graduating change agents who are having an effect not just locally, but on a state-wide level. Implications and areas of current and future research are discussed.

Introduction

In the roughly twenty years that desktop computers have been placed in schools, billions of dollars have been spent in the purchase of hardware and software. Over the last ten years questions have been raised about the effectiveness and results of this investment. Research has been at best spotty in showing improvement in student performance as a result of computer use, regardless of the type of assessment used (Trotter 1998). Lack of staff development in technology for teachers has emerged as one of the favorite explanations for this perceived failure of computers to cause increased performance. As a result, preservice teacher education programs and inservice programs for practicing teachers have begun to focus on providing teachers more training in the use of computers. And while research has begun to look at the effectiveness of these programs, little or no research has yet looked at the impact of a masters program in instructional technology (IT) for practicing K–12 teachers on their classroom practices and computer use. This study is an attempt to determine this impact, if any, in particular in a program that emphasizes the integration of technology and curriculum reform, rather than focusing merely on specific technology skills. This paper will use exit survey and case study data in an early attempt to determine the impact of the El Paso Technology Innovation Challenge Grant on the masters program cohort teachers, their classrooms, and their schools.

The Technology Innovation Challenge Grant's Masters Program in IT

The Technology Innovation Challenge Grant (TICG) is a five year, $3.4 million federal grant focused on systemic education change. The grant was awarded in 1995 and is scheduled to run through the summer of 2000. Its main areas of focus are on providing Internet connectivity in fourteen partner schools, increasing parental involvement in their children's schools, and professional development in instructional technology for K–12 classroom teachers.

In addition to providing wiring infrastructure for the partner schools, the grant provided multimedia computer stations for each schools' parent center, including a scanner, digital camera, videocamera, large screen TV monitor, and VCR. Parent centers were also given laptop computers for parent check out. Parents volunteer a certain number of hours, take some technology training, and then have the opportunity to check out the computers for home use.

The masters program in instructional technology is designed to provide K–12 classroom teachers training in the effective and innovative use of modern multimedia and communications technologies in the classroom. The focus of this program is less on the learning of specific computer skills than it is on new methods of using these technologies to improve student learning. The two year program includes four

technology classes, four general education classes, practica in mentoring and classroom action research, and two electives. Teachers enter the program in cohorts of 15–20, and generally take all their classes together.

In the technology classes, education in specific technology applications and methods is combined with broader readings and discussions on issues such as the critical use of technology in education, education reform, and current theories of teaching and learning. In addition, many of the other classes, including both practica and electives, are taught by faculty working for the grant. Thus the philosophical/theoretical outlook proposed by the grant permeates the program and even extends into the grant's other areas, in particular parental involvement. I am one of two teachers of the technology classes, and was brought into the grant in its third semester, in the fall of 1995, when one of the original instructors left just before the start of the semester.

Literature Review

Like the Challenge Grant program I'm involved in, and other projects discussed below, the Apple Classrooms Of Tomorrow (ACOT) professional development program emphasized issues of curriculum integration and pedagogy as much as the learning of specific hardware and software skills. Early findings were that teachers implemented more constructivist, interdisciplinary, student–centered projects in their classrooms. Modeling expected outcomes and teacher practices was an important factor in encouraging this transference (Apple Computer, Inc. 1995).

Of particular note for my study are some of the suggestions found in the ACOT report. For instance, two types of instruction were offered, four week summer institutes and one week in–school practica. Attendance at either the summer institute or both programs led to greater change in classroom practices, and suggests a model that combines intensive institutes, exposure to actual classroom practice, and time to plan and design new curricula throughout the school year. This is interesting from my perspective because it is in large measure what our program offers. A university–based program also helps address a need observed in the report for ongoing support not just in technology skills but in implementation efforts, regardless of the level of support available in the school. Thus a university–based program with the theoretical perspective of the ACOT inservice programs seems well placed to offer the most effective environment for encouraging long–term structural change in education from the classroom up.

Norton and Gonzales (1998) provide a research report that directly examines the relationship between the inservice instruction provided and changes in the classroom practices of the participants. Using a combination of quantitative and qualitative measures, Norton and Gonzales support and build on the themes introduced in the ACOT reports. General findings from the Norton and Gonzales report show both increased use of technology with students and a shift towards integrating computers with content learning. And while the quantitative instruments didn't look for a more student–centered, constructivist classroom, both instructors and participants indicated a greater awareness of these new techniques and theories of teaching and learning, an interest in applying them in the classroom, and a belief in the benefits of having these methods modeled. Almost all teachers reported using or adapting in their classrooms at least one of the projects created during their training.

Jeff Archer reports in *Education Week's* Technology Counts issue (Archer 1998) on Harold Wenglinksy's latest research, which draws a connection between math scores on the National Assessment of Education Progress (NAEP) and computer use. This research is an example of a new trend in the research which looks at types of technology use when attempting to observe learning differences related to technology. Wenglinsky found a positive connection between using computers for math and learning games (4th grade) and simulations and applications (8th grade) and math scores. This was opposed to using computers for drill and practice, which had a negative correlation to test scores for 8th graders and no effect in 4th grade. The report speculated that not enough fourth grade teachers were using simulations and application software in math for that to appear as significant factor at this grade level. Within the broad limitations discussed in the article, Wenglinksy's research is an early and ongoing attempt to determine a link between types of computer use and educational progress as measured by standardized test scores.

Archer's report on Wenglinsky's findings regarding teacher training are of obvious interest to this study. Archer found a positive correlation between teacher training in technology and test scores. This effect was greater in 8th grade, and any type of technology training made the difference. This very limited finding does lend some quantitative support to the importance of teacher development in technology. While this report did not examine types or amount of training for their effects, the author suggests the obvious assumption,

supported by some research, that more training leads to more innovative uses of technology along the lines that the report found most effective in improving test scores.

Programs that focus on a combination of curriculum and technology training in their programs tend to concentrate on creating student–centered, constructivist classrooms. These types of classrooms are supported by the innovative uses of instructional technology emphasized in these inservice programs. The Wenglinsky research also addresses the critical issue of types of computer use, and supports calls for more innovative uses of computers to improve student performance, as well as continued teacher preparation in technology. Based on this research, technology instruction that focuses on changing teaching practices first, and ways of using technology to support that transformation second, could help change the instructional paradigm more than a focus on hardware and software.

While there are themes emerging from the recent literature on new methods of instructional technology education, research is still lacking on the effect of a university–based masters program in instructional technology on the classroom practices of teachers. The masters program examined in this study incorporates the new inservice notions described above. Findings in line with these other studies would help establish a new model for providing inservice teachers effective guidance in the use of new computer and communications technologies to transform the practice of education.

Data

A major initial data source for evaluating the masters program impact is an exit survey given to participants in the TICG masters program at the end of their technology sequence. This anonymous, open–ended survey includes five questions e–mailed to the cohorts after their final technology course. The questions are:

1. The greatest impact on my teaching as a result of the Challenge Grant has been...
2. The least useful part of the Challenge project in enhancing the education for the children in my class is ...
3. The strongest evidence I have that highlights the effect of the Challenge project on my students is...
4. The following should have been added to the Challenge project in order to have helped me become a more effective teacher...
5. Please add any additional comments that you feel are relevant to your experience as a Challenge project participant.

Three cohorts have finished the program, and data is given for the 37 of 49 (76%) teachers who responded.

Six main strengths or outcomes from participation in the program were identified by survey respondents (Table 1). They were: teacher appreciation of the program; increased teacher confidence using technology; increased student confidence using technology; improved use of technology; depth of student learning; and mentoring. These themes, and additional comments by teachers on the surveys, again mirror many of the findings of the research discussed above.

Category/Topic	Number of Teachers Who Addressed This Topic	Percentage of Total Responses to This Topic	Percentage of Teachers Who Addressed This Topic
Teacher Appreciation of Program	23	19%	62%
Teacher Confidence	22	18%	59%
Student Confidence	21	18%	57%
Improved Use of Technology	21	18%	57%
Depth of Student Learning	16	14%	43%
Mentoring	15	13%	41%

Table 1: Positive Impacts of Program

Teacher confidence is a common theme through the research. Without feeling confident using the technology, teachers will never use it in innovative ways. Teacher and student confidence accounted for over one third of all responses on program strengths, with both topics addressed by almost sixty percent of teachers. This topic was addressed much more by the first two cohorts than the third (Figure 1), indicating a possible trend towards people with greater skills entering the program, and thus needing less confidence building.

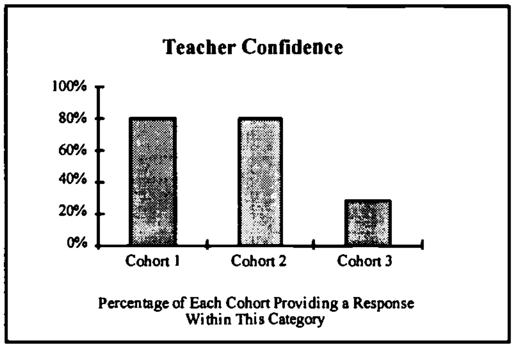

Figure 1: Increased Teacher Confidence

Improved use of technology is obviously something we would hope to find, and 57% of teachers addressed this topic. Some teachers mentioned better integration of technology into the curriculum while others spoke of a more transformational change from director of instruction to facilitator of learning. The first and third cohorts responded somewhat more to this category than cohort 2, possibly indicating the importance of the depth of the masters program in fostering change, as cohort two was endorsement only, and thus only took the technology classes. Responses regarding depth of student learning supports this conclusion (Figure 2). All three cohorts responded relatively equally regarding the importance of mentoring.

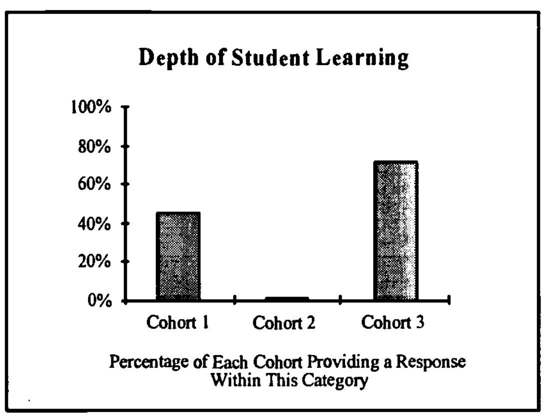

Figure 2: Increased Depth of Student Learning

While based on self–report data, these findings support those of other studies looking at the effect of inservice training on teacher practice. A combination of technology instruction, readings and discussions on education reform, and a focus on integration and innovation help teachers transform their teaching practice. Technology used for more than drill and practice can help this transformation to constructivist, student–centered classrooms. The following case study provides a look at the impact of the TICG masters program on one teacher, and tends to support some of the data discussed above.

Wendy Talbot

Wendy Talbot is a fourth grade teacher who completed the masters program with cohort 3. She is in her fourth year of teaching, all at the same school, and is participating in a looping experiment in the 3/4 and 5/6

grades. This means that her fourth grade students this year were her third grade students last year. I observed Wendy's classroom four times and followed this with an open ended interview. Informal conversations in and outside of school helped to clarify points, or lead to questions or areas of inquiry.

Wendy entered the masters program with many of the attributes we hope to see in our graduating teachers: a student–centered, constructivist philosophy and a good grasp of more than basic technology skills. She attributed her philosophy to outside readings and observations of other teachers, but specifically not to her observations as a student teacher or her preservice teacher education. Her constructivist bent was confirmed by classroom observations, within the limitations discussed below.

Confirming one of the possible trends found for more experienced computer users in the exit survey data, Wendy reported the greatest impact of the Challenge Grant program being

> the integration. To think about the existing curriculum. It's not like you have to change everything. But integrating stuff you already have ... and thinking how technology can make it even more effective. So my key word would be the integration part of it, the integration of the curriculum.

This puts Wendy in the improved use of technology theme in the exit survey data.

In addition to her view that the Challenge Grant helped her in integrating technology more effectively, Wendy also commented on the depth of student learning:

> When you do student learning type things, you students are working at higher levels, and there's more higher order thinking skills. When it's teacher driven, it's not the same thinking, it's not the same kind of achievement you get from the kids.

Observations of Wendy's classroom and interview data confirm that she struggles with a mix of innovative and test–related teaching. She even commented that the students know the difference when they're doing "fun stuff" versus test stuff. Wendy clearly prefers a student–centered, open–ended environment, with students in cooperative groups working on a variety of projects, and successfully creates this type of environment and large percentage of the time. While the masters program might not have affected her teaching practice due to it's already being in line with our goals, Wendy's responses on other issues confirm areas of impact in integration and deeper student learning supported by other Challenge Grant and research data.

Implications and Conclusions

Case study and exit survey findings from the El Paso Technology Innovation Challenge Grant master program begin to confirm other research on the effects of advanced technology instruction integrated with a focus on curriculum and reform. Since at least the 1995 ACOT report, a growing body of research indicates that advanced training in instructional technology should focus more on the creation of lessons and units that integrate technology in innovative ways into the curriculum. Outside readings that focus on reform and new teaching methods encourage change in teachers, both in their classroom practice and in their more activist roles in their profession. This is supported by my data, the exit survey data from the TICG masters program participants, and other research data (Apple Computer, Inc., 1995; Norton & Gonzales, 1998).

Participants in the TICG masters program, while still predominantly classroom teachers, are now found at all levels of the local and regional education system. Three are employed by the Regional Education Service Center, with a fourth employed at an Educational Service Center elsewhere in the state. Two cohort participants now work at the district level, while at least half a dozen are now technology coordinators in their schools. Many cohort participants at all levels, including Wendy, are involved in their school's parent centers, helping in technology training for parents. In all their positions, members of our program are training large number of teachers, students, and administrators. These educators are advocates for innovative, student–centered, constructivist, and critical uses of technology in the service of education reform, and are making an impact from the classroom on up. Through its focus on technology as an enabling tool for education reform, the Challenge Grant is helping to create a core of educators with new notions of the power and appropriate uses of instructional technology.

Future Research

This paper describes a beginning of efforts to determine the classroom impact of the El Paso TICG masters program in instructional technology. We are collecting a variety of data focusing on classrooms, schools, and grade levels. In collaboration with other Challenge Grants we are developing a self–report instrument for teachers regarding their classroom environment. Additionally, we are collecting data on the state–mandated standardized test taken by all Texas students. Results of the Texas Assessment of Academic Skills (TAAS) are being examined on a school–wide and grade level basis. We will be comparing results from our partner schools against those of non–partner schools. Another aspect of this analysis will be comparing our low income partner schools (south of the interstate) with non–partner higher income schools in the same district (north of the interstate). Results from this data analysis will be available in the spring

Additionally, participants in the program are given a pre– and post–survey covering computer attitude, efficacy, and use, demographic factors, and beliefs regarding instructional technology. As might be expected, early indications are that teachers come into the program with high levels of belief in the power of technology to improve their teaching and student learning. Results are too preliminary to determine any significant changes in these attitudes, but again this information should start to become available in the spring.

I will continue to conduct case studies, documenting a wide range of teacher situations in grant participants. I will use TAAS scores within grade levels of the teachers I observe to look for specific trends within schools with cohort participants. This specific information should integrate well with the larger data being collected grant–wide to help in the discovery of more or more conclusive emergent themes regarding the classroom impact of the TICG masters program.

While early results of El Paso's Technology Innovation Challenge Grant have been encouraging, little hard data analysis, qualitative or quantitative, has been done. However, that has become our focus this academic year, and will continue to be so for the rest of the grant. The awarding a new $9.8 million professional development TICG to expand this program should also help in the longitudinal data collection. Early data support existing research that a program that emphasizes reform, integration, and technology can positively impact teachers and encourage the creation of constructivist, student–centered classrooms. Technology can be a compelling force supporting and encouraging this transition. Data we are currently collecting will help determine whether we are having this type of impact, and furthermore whether this type of training and teaching truly results in improved student achievement.

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Teaching Online: A Professional Development Model

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Abstract: This paper describes the faculty training model utilized in the development and/or conversion of course materials to be delivered on the web. A description of the online learning environment will be provided, as well as the process by which faculty members in the College of Education interact with that environment during course planning and creation. The importance of faculty member's "early entry" into his or her virtual classroom is discussed in its ability to tap into prior teaching experiences and drive web course development.

Introduction

The development and/or conversion of courses to be taught in a web-based environment requires significant support for faculty involved in that process. Many times, teaching faculty members how "to teach online" requires that they be "reacquainted" with best practices in the traditional, face-to-face setting. Technology use is also critical in the development process. It is interesting to note that once the comfort zone is approached, and in some cases, established in the use of the technology, intuitive teaching practices seem to emerge, and even drive the development of web-based courses. The development model and its impact on the development and/or conversion, and ultimate maintenance of web-based courses at WTAMU in the teacher education program is described.

The Virtual Learning Environment

WTOnline is the virtual university at West Texas A&M University. It is composed of students and instructors who come together and fill spaces we know as classrooms—classrooms where real teaching and learning take place. The virtual classroom is mediated through information technologies that promote learning at a distance, specifically, Internet-based instruction. It is important to note that in every case, technology is secondary to course content and should only be utilized to support the instructional environment. Two salient features, structure and support, have driven the development of the virtual university and will be discussed as they relate to its ability to support instruction.

Online Structure and Support

Structural concerns of the virtual university include organizational and technological issues. Organizational issues focus on the people aspect of the university, while technological issues focus on the creation of the virtual environment.

Organization

The salient feature of WTOnline is its people. Each contribute in a unique way, providing support

for the student whom enters the virtual classroom and the faculty member who teaches there. The following contributions are made by each:

0_ The faculty members are the content experts, instructional designers, and in some cases, HTML authors.
1_ The student-based Web Team creates and maintains the virtual learning environment and provides web programming, as well as HTML authoring expertise for faculty.
2_ The Web Programmer performs server-side programming and administers the website.
3_ The Director of the Instructional Innovation and Technology Lab (IITL) provides oversight for the diverse groups involved in the virtual university, administration of the site, and training and instructional design assistance for faculty.

It must be pointed out that a team mentality further supports the organizational aspect of the online university; the participants share many tasks. The team members work together the semesters prior to and during the delivery of instruction. In addition to the support of the web team and the director, each faculty member is assigned a part-time graduate student to facilitate the process.

Support structures are also available for students taking the online courses. Content questions are directed to faculty via e-mail and chat sessions. Technology related problems are handled through the student-based dial-up help line and the employees of the IITL.

Technology

The flexibility of the web-based interface used in the development of the virtual learning environment is natural and instinctive in the platform-independent delivery of instruction. More importantly, the web's ability to support a multiprotocol environment has put the tools of teaching and learning into the hands of faculty and students. The user-friendly interface provides access to the hardware and software which supports WTOnline, including the web server, mail server, and chat server. This access flexibility is apparent in the internal and external navigation set up for the virtual classroom.

Internal navigation provides access to the resources inside of the classroom. Clicking on the indicated buttons on the navigation bar accesses the following resources:

0+ Go to Unit – provides access to the weekly unit of study.
1+ Calendar – provides access to the upcoming events in the class.
2+ Chat – a java-based chat is used to support synchronous communication in the classroom. Each class is allotted one chat room, which can only be used by class members.
3+ E-mail – provides access to an interactive form where instructors', classmates', and/or technical support personnel names can be checked off a list, submitted, and a new message page is spawned correctly addressed.
4+ Forum – each class has a forum (threaded discussion) set up in support of asynchronous discussion.
5+ Peer Expertise – web pages set up for the sharing of group projects. These pages are automatically posted via interactive forms.
6+ Student Homepages – biographical information and a picture is provided in this area. Further links to the student's portfolio of work. These pages are automatically posted via interactive forms.
7+ Syllabus – traditional classroom information is always accessible.
8+ Help – tutorials, FAQs, and interactive help request.

External navigation or the ability to "change channels" is provided in another navigation bar and includes a link to the virtual university homepage, the university homepage, and the university library.

The Adult Learner

Familiarizing faculty with the online learning environment means providing a comfort level with the technology. "As learning networks are increasingly adopted as part of the learning process, teachers will

need corresponding support to integrate these new tools into their teaching and professional development activities" (Harasim, Hiltz, Teles, & Turoff, 1995, p.44). Consequently, technology training is critical as instructors learn to negotiate the emergent teaching and learning environment. The following factors have been identified as crucial to effective technology training for educators.

0. voluntary participation (Harris, 1994; Schrum & Fitzgerald, 1996)
1. needs-based (Collis, Veen, & De Vries, 1993; Dyer, 1995; Nemeth, 1993; Wesley &Franks, 1995)
2. ample time for experimentation, exploration, and integration (Harris, 1994; Schrum, etal., 1996; Siegel, 1995; Strudler & Powell, 1993)
3. access to equipment and/or Internet connectivity (Harris, 1994; Schrum, et al., 1996)
4. administrative support (Honey & Henriquez, 1993; Schrum, et al., 1996; Strudler, et al., 1993)
5. on-site support (Barron & Ivers, 1993; Honey, et al., 1993; Siegel, 1995; Strudler, et al., 1993)
6. collegial interaction (Schrum, et al., 1996; Siegel, 1995; Strudler, et al., 1993)
7. the incorporation of adult learning principles (Schrum, et al., 1996).

In most cases, these factors are present when faculty are recruited to teach in the online environment. An effort must be made, however, to begin where the faculty member is in his or her use of technology. In many cases, positive technology experiences must be provided.

Experience

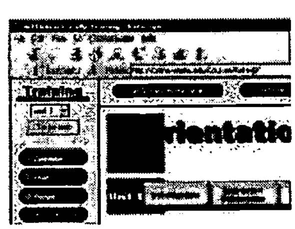
The most valuable resource the adult learner brings to a learning situation is experience (Holmes & Duffey, 1993; Lindeman, 1961). Dewey (1939) sees experience as the raw material the learner brings to the learning environment in the development of personal meaning. Rogers (1967) would argue that nothing can be taught that is not already known through experience. According to Knowles (1984), experiences provide the richest resources for adult earning (Knowles, 1984).

It is the lack of experiences in the use of technology that becomes problematic in the delivery of on-line learning opportunities. Goldenberg and Gallimore, (1991) stress that, "To understand how things work, it is necessary to have direct experience of them" (p.2). Few educators have had direct experiences with on-line technologies. Hiltz (1994) stresses that to be successfully involved in on-line professional development opportunities, the participants need some technical, as well as textual skills. A focus on the experiences the learner brings to the context should become the starting point for further learning (Dewey, 1933).

The experiences that the faculty members do bring to the training are those of teaching. While some instructors need to be "reacquainted" with best instructional practices, most bring an intuitive sense about what works and what doesn't in any classroom. Immediately placing faculty members in the virtual classroom immerses them in the technology, and provides them with the opportunity to do what they know how to do: Teach. Thus, the unfamiliar becomes familiar.

The Training Model

Training experiences are mediated in a "secure" face-to-face setting via the online classroom. Thus, instructors immediately gain experience in moving around the virtual space that will eventually host their course (Figure 1). Moreover, they are able to access the same material on the web for review and remediation when they return to their offices. The training content will be described in its ability to support



positive technology experiences.

Figure 1. Technology Mediated Training

Training Content

An Introduction to Distance Education

Faculty are introduced to distance education from a historical perspective. Facts and figures are provided in support of the "need" for institutions of higher education, as well as specific academic programs, to get involved in the delivery of instruction at a distance.

Orientation to WTOnline

As indicated, faculty members are immediately taken into the online classroom, where training materials are mediated. The technology is introduced in an effort to provide navigation, as well as functional orientation. Faculty members soon recognize that once they have mastered the training site, they have skills to develop and maintain their classrooms.

Development and Communication Tools

As faculty members are provided orientation to the training materials, they learn to use the development and communication tools which will help them interface with their online classrooms. Netscape Communicator(is the development platform for WTOnline, including Messenger for e-mail communication and Composer for web page development and publishing. The E-Share(chat and threaded discussion forum are also utilized. Training participants will use these tools to participate in all training activities, thus providing critical technology experiences.

Instructional Design Issues

A formal review of instructional design theories and models is presented. An effort is made to link these to each faculty members' individual, discipline-specific teaching experiences. Then, an example of how principles of instructional design have defined the development of an online class is presented.

Promoting Online Interaction

Designing for student/student, student/instructor, and student/content interaction is critical to the success of the online learning environment. Faculty are asked to consider ways that student interaction occurs in a face-to-face setting, and are reminded that the only way they know that their students are participating in their online class is if they "interact" with them. Methods and tools for interaction are utilized to help faculty understand this process.

Visual Design

Human-computer interface issues are presented in an effort to promote an effective learning environment. Specifically, text, color, and graphics issues are reviewed. Examples and non-examples are critical to this portion of the training since early inclinations in web page development are to include "all" the bells and whistles.

Analysis of Course Examples

Based on experiences brought to the training as educators, and the training materials provided in the training session, faculty members have the opportunity to evaluate three courses, as to instructional and visual design and opportunities for interaction.

Example Class Layout

Faculty are given a paper-based planning tool that shows the tools available to them in the online classroom. Because the training provides the technology-based experiences need to enhance their teaching and learning experiences, faculty members are now ready to make some decisions about design of their virtual classroom.
They are asked to think about what kinds of resources and activities are needed to support their face-to-face instruction, and how that might be accomplished in the online classroom (Table 1).

Traditional Activity	Online Activity
Lecture	web page
Handouts	web page, PDF, email attachment
Visual Presentation	web page, converted Power Point
Demonstration	Java
Chapter Outlines	web page, PDF, paper study guide
Supplemental Reading/ Info	Internet sites, PDF
Assignment transfer	email, HTML form, postal mail
Vocabulary	web page, javascript
Group Discussion	chat, threaded discussion, email
Test	HTML form
Quiz	self-correcting (javascript)
Research	online library services, Internet, electronic reserve

Table 1. Traditional Activity becomes Online Activity

Reciprocal Transformation

The quality of online courses increases as faculty members feel comfortable in using the tools available in the online university. The staff is often challenged to assist faculty in more complex applications of the technology in their courses. Consequently, more and better initial technology experiences translate into better courses and more effective training practices. Miles and Huberman (1994) refer to this idea as "reciprocal transformation" (p.58), explaining, "Teachers change the characteristics of new practices. Those practices, in turn, change the teachers and modify working arrangements in the classroom, which, in turn, influence how much of the innovation can be used, and so on" (p.58). Ultimately, providing faculty with the tools and support needed to teach in the online classroom will result in effective instruction.

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Learning with Technology: Teacher Education Faculty Development

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Abstract: This paper discusses the North Central Regional Educational Laboratory's professional development product: *Learning with Technology,* designed to help teachers of Grades K-12 integrate technology in their classrooms. After a brief history of the project, we introduce how this product has been adapted to provide a framework for teacher educators to redesign their methods courses and to integrate technology into their curriculum. The on-going research focuses on how the integration of technology in methods courses can thus improve the technology preparedness of preservice teachers.

Learning with Technology (LWT) was developed by the North Central Regional Educational Laboratory to help teachers use technology to improve student performance. *LWT* consists of a 6-week, 12-hour course for teachers, a 2-day Facilitators Academy and all accompanying materials (Participant's Manual, Facilitator's Guide, print and video scenarios, sample lessons) to help teachers use technology effectively and meaningfully in their classrooms.

In contrast to the usual software lessons, *LWT* is about enhancing teaching and learning through the appropriate uses of technology. It goes beyond the *what* of technology to the *how*, *when*, and *why*. Course participants using the materials view and analyze illustrative videotapes of technology integration, read and analyze print scenarios of various levels of technology integration, use technology-rich sample lessons to help them understand effective uses of technology, and participate in several Internet activities (e.g. web searches, web site analyses). They create instructional activities that use technology to promote engaged, meaningful learning and improve student achievement. The culminating activity is the completion of a technology enhanced lesson or unit plan. To date approximately 600 facilitators and 3500 teachers have been trained in *Learning With Technology.*

Because of its success as a professional development resource for K-12 educators, NCREL has encouraged alternative uses of *LWT* through meetings and conferences with representatives from various Colleges of Education across our region.
Discussions have centered on how *Learning with Technology* can also serve as a staff development tool for higher education faculty as well as a course for teacher education students. Some common issues and concerns discussed at these meetings have been:

- Graduating future teachers with insufficient technology exposure or expertise
- Providing faculty with professional development on how to use technology effectively
- Modeling technology use in the classroom for teacher education

- Providing incentives for faculty to follow through on resources available regarding technology integration

It was agreed that the ideas of engaged learning and technology integration should be infused throughout the teacher preparation curriculum, particularly in methods courses, assessment courses, and into student teaching supervision. The *LWT* materials have been used for university faculty development to help them learn to model engaged learning principles using technology.

As part of a higher education initiative, NCREL and NCrtec created a project that would use *LWT* as a professional development tool for pre-service teacher educators and as a course for teacher education students. Faculty members from the NCREL/NCrtec regions (Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, Ohio, South Dakota and Wisconsin) were nominated (by their deans, NCREL board member or NCrtec consortium members), screened and selected to collaborate on this project. The selection process considered candidates with prior experience using technology for teaching and learning, a commitment to the principles of engaged learning, and a willingness to create and pilot courses and materials in which technology is fully integrated into the curriculum.

In the summer of 1998, eight university faculty teacher educators were convened to co-design their methods of teaching courses. Each of eight teacher educators prepared modules of instruction that reflected engaged learning principles in the LWT course. Embedded in these modules were details regarding how the National Standards in their content area are addressed, how technology is actually used and how the integration of technology relates to the standards. The methods courses designed were:

<u>Introduction to Technology in Instruction</u>

Description/Activities: Electronic collaboration; electronic case studies; micro-teaching; professional portfolio; evaluating educational software; technology strategies for engaged learning, and electronic presentation of course portfolio.

<u>Elementary Science Methods</u>

Description/Activities: Reflection of elementary school experiences in mathematics and science; constructive friends activities; finding and using Web sites; integrated inquiry project; captured wisdom scenarios; science inquiry unit; field experience

<u>Junior/Senior High Literature Methods</u>

Description/Activities: Survey of hardware, software and communications; ethical use in technology development; high school book club (tutoring project); student teaching site visits and e-mail sessions; electronic presentations by pre-service teachers.

<u>Secondary Social Studies Methods</u>

Description/Activities: Introduction to engaged learning; planning a social studies lesson; social studies curriculum standards; print and computer-based tools for social studies research and lesson/unit planning; planning social studies lessons, units and courses; accessing and evaluating web-based information; creating WebQuests for social studies instruction

<u>Secondary Science Methods</u>

Description/Activities: An introduction to using the concepts of engaged learning in planning science instruction; finding, accessing and using internet sites; finding and participating in listservs; working with critical friends.

<u>Science for Life</u>

Description/Activities: Discussion of issues in science education; critical analysis of lessons/labs; design of lessons/labs; critical analysis of technology-rich teaching scenarios

Secondary General Music Methods

Description/Activities: Introduction to MIDI; lesson plan development; assessments for music composition

Integrating Technology into Teaching: Media and Methods

Description/Activities: Introduction to visual literacy, visual design; review of media tools; case-based or PBL applications with technology; introduction to the web, email, listservs; overview of engaged learning; portfolio creation.

Engaged learning and the integration of technology into teaching, authentic assessment and real learning tasks, are important ideas to incorporate in teacher education programs. The importance of effective technology integration to promote engaged learning in classrooms, both K-12 and higher education, is being researched by the faculty members chosen for the NCRtec project above. The design and development of these teacher education methods courses and their first semester's activities and experiences are currently being documented, and students' achievements and reactions are being surveyed and collected. The goal is to see if modules based on *LWT* and specifically designed components of methods courses could be scaled up throughout the region to other pre-service institutions. Issues being researched currently include those involved in adapting in-service resources to pre-service contexts and student work that resulted from a pre/post survey to measure impact in each methods course.

NCREL hopes to use these pilot projects and the ensuing research to begin to design materials and resources for Teacher Educators, including on-line resources, so that others interested in innovative teaching strategies can be aided by the models and modules designed and piloted in this project. Others interested in the LWT materials or this research project can contact the authors for further information.

CMC as a Facilitator for Teacher-Student Communication

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Abstract: During these times of increased budget awareness in many institutions of higher learning, the dilemma of increased class size with reduced faculty has moved to the forefront of considerations. Several institutions have also increased the course load for junior faculty in order to cover vacated senior faculty positions that will remain unfilled. Overall, the students may be more likely to receive a less personal, more lecture-based education than in previous years. Literature indicates that this trend can reduce the quality of the educational experience for the student. The authors present the findings of two instructors who chose computer-mediated communication (CMC) as a means to strengthen the educational experience for their students while dealing with the realistic constraints of their teaching environments.

Introduction

During the past decade, institutions of higher learning have focused a much more discerning eye on expenses and budgets. This increased awareness has resulted in close scrutiny on the necessity of a great number of classes, faculty members, and even departments. As a protective response, a few less drastic options have surfaced. One of these options being explored is increasing the course load for faculty, thereby reducing the total number of faculty necessary. Another option involves increasing the number of students serviced by any given course. Several institutions which are more severely impacted by budget constraints are combining these options by both reducing the number of faculty through retirement incentive programs and unfilled vacated positions, and increasing class size.

Problem Statement

These considerations are imperative given budget problems, but little overt examination is given to the impact on the student. With the reduction of course offerings, and increase in class size, the students will more likely receive a less personal, more lecture-based education than in previous years. Educational research indicates support that this combination can lower the quality of the educational experience for the student. Comments from faculty point to a growing number of individual student complaints about reduced instructor immediacy or availability for personal or small group interaction. Student Opinion of Instruction (SOI) evaluations reflect increased dissatisfaction with regard to the reduced availability of the instructor for individual conferences and questions. Clearly, again according to SOI comments, students would be agreeable to the increased ratio if in response the teachers were more available to them outside scheduled class hours as a compensation for the loss of individuality in the educational experience.

With the supplemental responsibilities accorded instructors, as well as the oft-increased course load, the task of finding additional time to meet with an increased number of students seems daunting if not overwhelming. The bright light at the end of the tunnel is a potential resolution. In our technological age, students have abundant access to computer-mediated communication (CMC) facilities. Incorporating CMC into the classroom routine would prove a great facilitator of the communication process. CMC is already a popular tool utilized by many instructors as a way to dispense and collect assignments, administer tests, and as a general link for communication between student and instructor. For many educators this avenue seemed too impersonal initially. Typing on a keyboard while looking at a monitor did not fulfill the link of a face-to-face discussion. Most notably there is a perceived loss of facial cues, posture, eye contact, immediacy of dialog, pitch, vocal

tonality, verbal rate, and pausing, to name but a few nonverbal characteristics that were absent from CMC communication.

Educators who invested in CMC communication with their students from early in the process indicated that the pros outweighed the cons. As technology has improved and become more widely accessible for both faculty and students, the praise has grown dramatically. As with any positive change, familiarity increases confidence and utilization over time. That trend extends to CMC. Those using CMC generally find that once they have become comfortable with the process, any question or concern can be sent – regardless of length – at any time of day or night. This realization involves the elimination of a barrier not even associated previously with CMC. Time constraints are virtually eliminated for all parties involved in the CMC, resulting in an asynchronous communication which allows all participants to interact within the bounds of their individual schedules. The student is now able to study at his or her own pace and time of day. A question can arise at any time of day or night, and the instructor is perceptually "right there" as the student can e-mail that question without the worry of waking anyone or missing office hours due to conflicting time schedules. E-mail can then be checked by the instructor from any location at any time. This availability also allows the instructor the luxury of prior thought for a better response. The simple ability of asking a question at any time on any given day logically increases the perception of teacher immediacy for the student, even though they realize that they may not get a response immediately. If there is a student group that needs to meet for a class project, they can arrange to meet on-line to facilitate a discussion. If this particular group is having problems, it can be arranged to have the instructor "sit in" at an on-line meeting to discuss difficult or sensitive matters, even if there are participants in geographically distinct locations.

This paper will explore the experiences of two instructors who have chosen CMC as the major means of student-teacher communication. These instructors adopted CMC for differing reasons, but achieved surprisingly similar results. First we will examine the experience of the instructor who adopted e-mail as a means of communication due to geographical constraints. Second, the experience of an instructor who adopted the asynchronous method to facilitate communication due to difficulty in accommodating student interaction through traditional means, will be illuminated.

Instructor One

Instructor one, we will call her Ms. Jones, teaches a course to a small group of geographically distributed students. The class cannot physically be located in one place, although the students do not have time constraints that would prohibit a synchronous meeting time. Originally, Ms. Jones taught the course in a manner similar to traditional correspondence-based courses, with the exception that she had definite due dates for all assignments so that student answers could be compared and contrasted and relevant issues brought forth to students. Increasingly, she became aware of the improvements in the learning experience that could be observed if the students were able to interact with each other. The broad scope of student experiences would provide an excellent foundation for discussion. She has gradually migrated her class from a correspondence course to a semi-synchronous course using e-mail. E-mail discussion session were set up at prearranged times with student required to participate in at least 8 of the 12 scheduled sessions. Students were given the topic of the discussion by Ms. Jones at the start of the arranged time period, and all discussions were broadcast to all group members. Although there was no specific requirement for interaction beyond "signing in" and "signing out," all students participated in the "virtual conversations" to a satisfactory degree.

This investigation into this delivery method has Ms. Jones and her students very excited about the possibilities for future courses. Although this simple method of communication works for this population and marks an improvement over the previous methodology, there are more advanced tools for accomplishing this objective that are being investigated for incorporation into the course. With the new technologies, come new expenses, so for now, e-mail remains the communication method of choice for Ms. Jones.

Instructor Two

Instructor two, we will call him Mr. Smith, is an adjunct professor who teaches part-time in the evening while he works in a full-time professional position during the day. There is no designated office space for Mr. Smith, which he would not have time to use if there were. He has a sincere interest in helping his

students, but time availability is low. Two years ago his class size was increased by 30%. This increase eliminated class time previously available for individual conferencing, and increased the time necessary to grade student activities, thereby completely eliminating any student availability for any contact other than dire emergency. Student and teacher dissatisfaction with the classroom experience grew.

The availability and ease of CMC was brought to Mr. Smith's attention. In an attempt to regain educational satisfaction and quality, he decided to incorporate CMC as a basic routine in his course. At the first class meeting Mr. Smith gave each student an e-mail account, and stressed that e-mail was the best way to communicate with him outside of class. Any questions or concerns or general comments would reach him most easily via e-mail, and he would be able to answer or respond much more quickly. Mr. Smith was a bit concerned initially about reticence from non-computer-literate students, or those who dismissed technological progress actively.

What Mr. Smith came to find was both relieving and astounding to him during the first semester. Most students either had e-mail accounts already, or had been wanting one. Those students who were not familiar with CMC in particular, or computers in general, were offered assistance by other students, thereby increasing student interaction and bonds which would prove valuable as the semester progressed. Those students who actively eschewed technology responded in one of two ways. Either these students allowed themselves to use e-mail, reasoning it was a necessary component of the course, or they preferred to leave notes in the instructor's in-box to be answered with a phone call. This second option was less timely, but satisfaction was still higher for those students as they were being accommodated.

Mr. Smith had an improved level of motivation and satisfaction for the class. He felt less overwhelmed by time constraints, and overall more comfortable as the students were able to reach him in a manner easier to all involved. The only negative concerns came about involving misinterpretation of comments due to a lack of vocal intonation, or differing word choice perceptions. Overall, however, the experience was a positive one. In subsequent semesters, these positive findings have been reiterated. Students were at ease in sending a question when it first occurred to them, represented by the large number of student requests which were followed by secondary e-mail requests to "disregard previous message...I figured it out." Students perceived instructor immediacy through the availability of e-mail.

Findings

The use of CMC as the primary communication channel was found to be beneficial to both students and instructors as requests could be handled at the convenience of the interactants, rather than at a future date when both would be available at a mutually agreeable location. A noticeable benefit was that both students and instructors were able to review, reread, and think through their communications prior to sending them. This resulted in clearer messages from the students, and clearer responses from the instructors. An added bonus was that instructors had potential research time to investigate issues presented by students prior to answering the inquiry. The benefits of CMC are known to almost all whom rely on it as a form of communication. The added benefits of using it as a tool to facilitate the teacher-student relationship are several. Although there are other technologies that could facilitate student interaction, for these instructors, e-mail communication assists in time management, stress reduction and increased efficiency and effectiveness. For the student, e-mail begins to compensate for a less individualized classroom experience by renewing perceived instructor immediacy.

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The Need For Training Standards In New Technologies For Inservice Teachers

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Abstract: The success of any innovative new technologies training in achieving its goals and objectives rests, finally, upon the support of the teachers. This report focuses on the status of training standards and professional development guidelines for teachers. A policy analysis strategy was used to examine the current standards for professional development that govern technology training for teachers. It is contemplated in this paper that a clear vision of training may help conceptualize the capacity of current technology training standards to support the professional development needs of inservice teacher in new technologies and thereby, increase technology integration in learning and teaching. An examination of current standards unveiled technology training priorities are not focused on technology professional development for inservice teachers. Consequently, policymakers and educators need to reconsider current professional development standards because the training needs of preservice, new teachers, and inservice teachers may be different when learning new technologies. This difference in training needs may have an impact on teachers' capacity to integrate technology in the classroom.

Introduction

This paper is the first of three papers that will examine technology-training practices for inservice teachers and the need for training standards. Professional development and training of teachers in new technologies are getting enormous attention as a part of school reform efforts **(Means, 1996; Means & Olson, 1995)**. The purpose of this report is to focus attention on the need for training in new technologies for teachers. Currently, technology training standards for teachers may be inadequate because they do not provide an articulated vision for training inservice teachers in new technologies or result in increased technology integration in classroom practice **(NCATE/ISTE, 1997; iste.org).**

Exploring new technology professional development and training for inservice teachers might help determine the capacity of current professional development guidelines to support, enable, and empower teachers to effectively integrate new technologies **(Hammond, 1998; Warren, 1998).** The National Foundation for the Improvement of Education (NFIE) propositions that a need does exist for new professional standards to train inservice teachers in new technologies **(NFIE, 1996).** Another group of policymakers have suggested new technology training standards for preservice and inservice teachers should be connected to current technology teacher education standards (National Educational Technology Standards for Students -**NETS, 1998**).

The Problem Statement

The United States does not have a professional development system for approximately 3 million inservice teachers; nor does it have standards for training these teachers **(Hammond & Ball, 1997).**

> It seems to me that building knowledge and capacity in schools will require constructivist relationships between research, policy, and practice that allow

reciprocal learning to occur. We cannot hand knowledge to policy makers to enact in new mandates. We must work with policy makers to develop strategies for professional development that will infuse strategies for professional development that will [in turn] infuse greater knowledge in schools and with schools of education [continuing]. Linda Darling-Hammond, Presidential Address, AERA 1996 Annual Meeting in New York).

Our system of professional development is consistently depicted in literature and research as inadequate to train teachers in new technologies **(Moursound, 1997).** Recognizing this lack of concentration on professional development of inservice teachers in new technologies, the U.S. Department of Education established National Education Goal 4, Teacher Professional Development as a national priority (National Education Goals Panel - **NEGP,** 1995).

The Study

The purpose of this literature and policy review was to uncover why current training standards may be lacking in their ability to guide training in new technologies for inservice teachers. The literature infers that new standards are necessary to support best practices for technology training. Presently, the capacity and complexity of current proposed National Council for the Accreditation of Teacher Education and International Society for Technology Education's technology standards to incorporate a focus on inservice teachers appears relatively unascertained **(NCATE/ISTE, 1997).** The NCATE/ISTE standards is one group that has made significant progress in helping teacher education programs to integrate new technologies training for educators and preservice teachers. However, these standards may not be satisfactory to prepare and support inservice teachers in new technologies. This potential inadequacy is somewhat evident when we consider the slow pace of technology integration by teachers into instructional practice **(Office of Technology Assessment, 1995).** Experts such as Larry Cuban (1997) advocate that teacher's involvement is paramount to planning professional development or new technologies training **(Cuban, 1997).** It is important because teachers' attitudes and perceptions about technology and teaching priorities may be, to some extent, related. Educators, practitioners, and policymakers tend to agree technology professional development of teachers needs reconceptualizing as an ethos--ongoing and forever changing vs. a training program **(California Department of Education, 1998; Hammond, 1997).**

In this review approximately 25 technology training models were reviewed. Three of the 25 models unveiled promising best practices for future technology training standards for teachers. The three models were Apple Computers of Tomorrow, Iowa State University's Mathco Professional Development School Initiative, and the University of Virginia, The Curry School's Technology Infusion Project (Yocam, 1997; Thompson, 1997; Nonis, 1997). An evaluation strategy called the AEIOU (accountability, effectiveness, impact, outcomes, and unanticipated circumstances management) method, which is proven effective for analyzing technology training models was one of the primary strategies for evaluating and comparing the various features of the training models (Sorensen, 1996). Several evaluation models were considered to review programs to determine best practices when analyzing professional development and training programs in technology. A few of the best practices in the models included, but were not limited to:

1) Centered on training needs of each individual teacher (Thompson, 1997);

2) Connected to new technologies (Yocam, 1997);

3) Integrated research to plan future professional development (Yocam, 1997);

4) Planned collaboratively by those who would participate in the training (Nonis & TheCurry School, 1997); and

5) Connected to higher education and business/industry partnerships (Thompson, 1997; Yocam, 1997).

A clear vision of training goals as represented in the three selected models, may help other schools to conceptualize technology training standards for teachers. This need to rethink training is

supported by Moursound's perspectives on the weaknesses of professional development for teachers in new technologies. This weakness reflects a serious concern about the adequacy of current standards and professional development training models to accommodate the training needs of all teachers.

Findings

Seventy-three percent of the public school teachers in need of training in new technologies are women and minorities (NCES 98-015, 1997). Despite current technology guidelines and standards, most of these teachers have not had adequate training to prepare them to use basic or new technologies. An Association for Supervision & Curriculum Development Study (ASCD), Models of Reform, a comparison of 12 most widely used implemented education programs for schools with high percentages of at-risk students were studied. An analysis of the professional development in public schools in these public schools unveiled . traditional training features (Wang, Haertel, & Walberg, 1998). These were traditional professional development and training practices currently used to train practicing teachers were also evident in teachers' attitudes toward reform efforts in another study, the Public Education Teachers' Survey **(ASCD, 1997)**. Only one of the 12 models in the reform study included any reference to training in technology during a time when technology training is considered a priority training need for teachers. While, it is generally agreed few researchers have empirically tested practices to train teachers in technology use, training efforts must be focused in this area or we cannot assess the impact of technology integration or other reform efforts. Three areas emerged in this examination that affect high quality training in new technologies for teachers. The lack of:

1) Infrastructure for inservice teacher training;
2) Support framework for technology training; and
3) Research-based practices to improve training.

USDE's Teacher's Participation in Professional Development Report shows only a little over 50 percent of full-time public school teachers reported participating in professional development on uses of technology for instruction **(NCES Study, 1994)**. Consequently, knowledge of the relationship between these variables and technology integration by teachers is limited. However, this information may help teachers, educators, and policymakers design technology professional development that maximize teacher performance outcomes from technology training. An examination of technology training infrastructure unveiled that 18 states do not require teachers to have technology training for licensure or certification. The study also showed that even when training was connected to standards it was often supported by one-size-fits-all workshop models. Repeatedly, expert practitioners and reformed-minded technology educators continue to portray the one-size training models as failing to maximize potential teachers, new technology, and resources **(Yocam, 1997; Rigdon, 1996)**.

In 1998-99 over $30 million was awarded for professional development for inservice teachers to support the evolution of a national professional development training model or institute that is focused on technology integration and training teachers **(Coley, Cradler,. & Engel, 1997)**. However, there are no shared standards for these funded initiatives for training inservice teachers in new technologies **(Garnett, 1998;** www.ed.gov/Technology/ challenge). Fortunately, this support has contributed to a small cadre of exemplary professional development technology models **(Solomon, 1992)**. Through partnerships of businesses, educators, administrators, and teachers have taken responsibility to collaboratively develop guidelines and standards for technology training to support their unique needs **(Thompson & Sharpe, 1997)**. The ability to determine which practices work is central to improving technology training for teachers.

In the look into research-based practices, investigations revealed that very little research has been done on a national level to study teacher training in new technologies. The absence of this data seems to seriously affect policymakers decision-making about the best practices for technology training for teachers. A small selection of studies referenced connection between general professional development or technology training to student achievement **(Yocam, 1997)**. Current standards are focused more on teacher education accreditation and teacher certification or licensure. So far, no one group appears responsible for new technology training standards for inservice teachers. The next discussion continues to the question of what current technology and professional development standards look like for teacher education. Selected groups of policymakers have advocated linking inservice teacher technology training to preservice teacher

education and training. What do current teacher education standards look like? There are three distinct teacher groups: 1) Preservice, 2) New, and 3) Inservice Teachers.

The intent is to focus the argument on training standards for inservice teachers. However, to establish a rationale for the question that is being raised, I believe it is important to explore current standards to establish a foundation to explore whether or not new technology training standards for inservice teachers should be linked to standards designed for preservice and new teachers. Policymakers have expressed a position that standards for professional development of teachers to use new technologies should not be isolated from other standards to which teachers are held accountable.

In this literature review an analysis of current standards unveiled technology training priorities are not focused on technology professional development for inservice teachers **(Anderson, 1997)**. Given the limitations of existing knowledge about technology training standards, two questions emerged: 1) What are the similarities and differences in the professional development and technology training needs of preservice, new, and inservice teachers? and 2) Do they have the same training needs in learning new technologies?

Discussion

In the examination of standards preservice teachers the work of the International Society for Technology Education (ISTE) and NCATE (authorized by the U.S. Department of Education to develop foundations in technology standards) emerged as the most influential groups in policymaking for teacher education programs. Recently, the National Educational Technology Standards (NETS) Project was formed to foster collaboration among the many policymaking teacher education organizations for technology standards for students. For new teachers two policy groups emerged in this arena---National Board for Professional Teacher Standards **(Snowden, 1993; NBPTS, 1993).** Passing for teachers offers higher level certification for teachers, higher pay, and professional status. However, the current standards and process does not include a technology component and in reality targets the experienced teacher. Another group, the New Interstate New Teacher Assessment Consortium offers support for new teachers in terms of interstate collaboration involving licensing and certification processes and beginning competencies for new teachers **(INTASC, 1997).** The INTASC has three core areas, ten general professional development and teacher education principles, and does not include a technology focus.

However, for inservice teachers the examination of the policymaking environment only found two groups that approach standards for inservice teachers. National Board for Professional Teacher Standards and the National Staff Development Council **(NSDC, 1997).** Despite these groups interest and support for professional development for teachers, there are no specific components to assess or provide training in technology skills for these teachers. The NSDC organization provide support at various levels, but it is generally based on the traditional professional development workshop format in areas other than new technologies. Considering it has been proposed to link new professional development standards for inservice teachers to current technology and teacher education standards, NCATE/ISTE might be considered the current supporting standards. However, this does not come without some risks. Adapting teacher education standards for inservice teachers without substantial input from them could potentially result in a mismatch between training standards and the reality of what teachers need to know and be able to do to integrate technology **(Goodlad, 1991).** Appropriate research about revising current standards for to address inservice teachers' technology training may reduce the potential for a mismatch between teachers' training needs and new training standards.

Conclusions

Consequently, based on the finding that current technology training standards developed by policymakers and educators need to reconsider current professional development standards because the training needs of preservice, new teachers, and inservice teachers may be different when learning new technologies. This difference in training needs may have an impact on teachers' capacity to integrate technology in the classroom. This paper is the first of three papers that will examine technology-training practices for inservice teachers and the need for standards.

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Probability Park
A Database-backed On-line Professional Development Environment Targeting Standards-based School Reform

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Abstract: The State of Oregon is undergoing massive standards-based school reform. This has created immediate and wide spread professional development demands. We have piloted an on-line professional development environment that targets probability and statistics standards and is designed to meet these demands in a scalable and cost effective fashion.

The environment is called *probability park* and consists of four parts: a communication center, a set of learning modules for teaching content, a resource room of classroom activities, and a verification institute that takes teachers through the process of judging collections of student work against criterion-referenced standards. This paper describes the structure of *probability park* both pedagogically and technologically. We show how we used specific technologies to achieve desired pedagogic ends.

Introduction

The state of Oregon is undergoing massive standards-based education reform in the public schools (Oregon Department of Education, 1998). This presents several challenges to teachers. Teachers will be required to expand their subject knowledge and to develop new curricula that more adequately prepare students to meet the state benchmarks. A key part of the student assessment process involves using state scoring guides to assign levels of proficiency to collections of student work. This not only demands an understanding of new evaluation procedures but also requires teachers to assign projects that can become useful parts of the student collections.

The challenges presented by school reform must be met by professional development programs at a level sufficient to transform an entire educational system in the space of a few years, but the traditional model of bringing teachers to two or three week long summer workshops cannot be funded at this level. In response to this we have piloted an economical and scalable alternative: an on-line professional development environment. This paper describes the structure of this environment both pedagogically and technologically. Our goal is to show how we have harnessed certain technologies to serve our needs and to share this knowledge with others. We do not have any results on the effectiveness of the our program and will leave that and other details for another publication.

Figure 1: Probability Park Logo

The Environment

Figure 2: Probability Park Navigation Bar Showing the Four Areas of the Park

The environment we created is called *probability park* (Birkes et. al., 1998). It targets state benchmarks and standards in the area of probability and statistics and was funded by the Eisenhower professional development program. At this point, about fifty in-service and about fifteen pre-service teachers are using *probability park.*

Many of the pre-service teachers will receive academic credit for successfully completing our program. The on-line environment consists of four parts which we will now describe.

The first part is a small *communication center* that facilitates email communication among users and between users and staff. The second part is a set of 18 on-line *learning modules* that teach the needed subject content. The learning modules include extensive client-side interactivity and a versatile pop-up window scheme, both of which are effected using a combination of Javascript and SQL interactions with a database. The learning module pages include dynamically generated links to state standards and classroom resources. Each module features a summary piece that serves pedagogically as an organizer and that exploits some true non-linearity in its user interface.

The third part is a *resource room* consisting of a database of classroom activities and projects tied to the state standards. Each activity is recorded on a "resource card" displaying information such as the title, author, reference and copyright information, relevant standards, overall idea, instructions for use, and modifications. Database technology allows any authenticated user to add content to a card by uploading a file from their desktop to the server. A link to that file automatically appears in the card.

The final part is an *on-line verification institute.* This addresses the needs of teachers to understand the process of evaluating collections of student work against state benchmarks and standards. The background for this is a new university admissions system called the *proficiency-based admissions standards system*, or PASS, that will be phased in at all public higher educational institutions in Oregon (PASS, 1998a). In this system, students are required to demonstrate proficiency in six content areas broken up into *proficiencies*, one of which is to "use probability and statistics to collect and study data". A primary means of verifying proficiency is by reviewing collections of student work samples. As the culmination of two years of research and work with 30 partnership high schools, the PASS project has developed a sophisticated one-day training session (PASS, 1998b) addressing the process of becoming familiar with a standard and using it to judge collections of student work. Our on-line verification institute is an abbreviated version of this training session. It includes on-line student work samples, a progressive set of forms that ask questions about these samples and about the standards, and the ability to view the judgements made by others as described later.

Off-line Component

Probability park is designed to be a self-contained on-line environment. But we do not feel that the typical middle or high school teacher can use it effectively without some instruction. Furthermore, our personal experiences with Web-based classes have indicated that on-line class-based communities do better after students have met face to face. For these reasons we introduced teachers to *probability park* by inviting them to the Oregon State University campus for a one-day workshop.

The main purpose of the workshop was to introduce the teachers to the on-line portion of the site. This was accomplished using a three-step process. First, we described the site using a lecture format. During this step we displayed a few of the pages from the site, but the teachers could not access them on their own. The second step involved meeting in a computer lab to walk through the site together. The teachers followed on their own desktops as the instructor clicked through a number of sample pages and interactions. In the third step the teachers went through all areas of the site on their own. They were given the assignment of working through the entire first (introductory) learning module, creating a resource card, getting started on the verification institute, and using the communication center to send email to everyone in the class. Participant feedback and our own observations indicate that this process is a very effective way of introducing an on-line environment.

Architecture and implementation

The *probability park* web site is a database-backed Web site. User information, tables of standards, resource cards, the contents of pop-up windows, and so on are all stored in tables of an Access database. We use Cold Fusion by Allaire Software to implement SQL queries and format the results into HTML.

The pages of probability park are formatted as tables with a frame-like navigation bar on the left, but we do not use frames. The reason for this is to increase disabled accessibility (W3C, 1998). The majority of pages are learning module pages. These were constructed by converting content written by the academic authors to HTML and pasting it into a template. Later modifications, such as the addition of Javascript routines for pop-up windows and other interactivity, use Cold Fusion "include" statements for flexibility and modularity.
An interesting feature of site is the interaction between Javascript and Cold Fusion. This presented some technical challenges since their variable spaces were almost distinct. We give an example of how this works below, and we are very happy with the results despite the awkwardness of their implementation.

Features

We now describe a few of the author and user interfaces and some of the ideas behind them. Our point in doing so is to illustrate how the technology can be used to achieve specific pedagogic goals. We comment that we know of no off-the-shelf course management system (McGreal, 1998) that offers the flexibility needed to accomplish what we have done here. The kinds of features we describe belong to the fundamental instructional design of an on-line environment, not to the set of tools available for delivering it.

Standards notes

Scattered throughout the learning module pages are buttons that say "standards note". These activate pop-up windows which display the Oregon benchmarks and standards relevant to the material on the page. There are two points to be made about these buttons. The first point is that they serve a vital pedagogic purpose. It is very difficult to understand the real meaning of a content standard in the abstract. By tying the standards directly to the content *as the teacher is learning or reviewing the content,* we hope to make a mental connection between the standards and what they represent. It is interesting to note that this use is more in keeping with Vannevar Bush's vision (Bush, 1945) of "associative trails" than the more common use of hyperlinks purely for organizing a series of documents.

The second point to be made about standards notes is that their simplicity belies the sophistication of their implementation. They are realized using the technology described below in the section on pop-up windows and database interaction. The standards themselves are stored in a database, and to insert a standards note in any page the author need only insert the code `<script>insertnote("codes")</script>` where `"codes"` is a list of codes for the standards that are to be displayed.

Resource cards

Resource cards are entries in a database of suggested classroom activities. We would like to describe two attributes of resource cards. The first is their tie to standards. When editing a resource card, there are checkboxes from which one can choose and appropriate set of state standards. The text of these standards are then looked up in a database and displayed in the card. The second attribute is the ability to upload documents. Each resource card has a button that allows any authorized user to upload a document from his or her local machine. The document is stored on the *probability park* server and a link to the document is created in the resource card. When a user activates this link, the document is delivered from the server to the user's Web browser. If the document is, for example, a text or HTML file, it will be displayed directly in a browser window. If the document is a program, spreadsheet, or word processor file, it will either be saved to a file or displayed using the appropriate application, depending on how the user's machine is configured.
The ability to upload documents has many uses. Authors can include more detailed documentation on an activity or include associated programs or data sets. Users can add annotations either for their own use or as suggestions for others to follow.

Module Summaries

At the end of each learning module is a "summary chart" that lists the main topics from the module on one side and has three columns labeled "definition", "idea", and "activities" across the top. These chars serve as

cognitive organizers for the teachers and are used to evaluate progress of those using *probability park* as a means to earn academic credit. The teachers fill in the charts themselves and may update them at any time.

There are limitations to the amount of textual information that can be displayed in tabular form on a Web page. This led us to build a drill-down model. The top level is an overview chart displaying the date on which each cell was last updated. To see or edit the content of a cell, one chooses the topic from one list of buttons on the left and the heading from a list of buttons across the top of the page. We hope this leads the user to think more in terms of relationships than the simpler navigational alternative of clicking on a cell to see its contents. (See the section on "standards notes" above.)

Summary Chart for Module 1

The following table indicates when you last updated each entry in the summary chart for module 1. To display or update an entry, check the topic on the left (Histograms, Stem and Leaf plots, ...) and the category (Definition, Idea, or Activity) across the top.

	Definition	Ideas	Activities
Histograms	09-Oct-98	19-Aug-98	19-Aug-98
Stem and Leaf plots	20-Aug-98	12-Oct-98	19-Aug-98
Box Plots	19-Aug-98	19-Aug-98	19-Aug-98

Figure 3: Summary Chart (Selection Buttons not shown)

Comparison of Student Work Samples

A final feature of note is the process by which we allow teachers to compare their judgements of student work samples to those of others. This takes place in the on-line verification institute and is an important part of the process. It usually provides teachers with evidence that their own judgements are reliable and consistent and validates their judgements against professional standards.

The way we implemented this was to create three phony users, PASS1, PASS2, and PASS3. After a teacher enters his or her own judgements, the scores and comments assigned by these three users may be displayed. Anyone with knowledge of the passwords can authenticate as one of those users and generate an "expert" opinion concerning work samples. This artifice enables us to easily enter and update the reference judgements and makes it possible to invite any knowledgeable person to do the same. It would be easy to add more distinguished user accounts should we so desire.

Pop-up Windows: An Example of Database Interaction

In order to give a flavor of our design we will present one example of database interaction that pushes the capabilities of the software but provides valuable user and author functionality. The functionality provided is that of pop-up windows. More precisely, in the learning module pages we want to be able to insert text that asks a question and provides a link that displays the question and an answer to the question in a standardized pop-up window. Using pop-up windows saves space on the page, adds a mild form of interactivity, and gives the user a choice of viewing or not viewing information. We point out that for usability reasons it is important that a pop-up window appear in front of all other windows when it is called and also when its contents are changed or refreshed. Otherwise a user might click on a link and see nothing happen because all of the action is taking place in a hidden window.

The main problems faced were on the authoring side. We wanted to make possible for an author with little knowledge of HTML to insert a question so that part of its text would appear as a link that pops up a new window displaying both the question and an answer. We also wanted to make it easy to edit questions and answers without needing to edit learning module pages. We will now explain how this was accomplished.

We started by creating a database table of questions with one column containing a reference to the module (but not the exact page) in which a question was to appear. We adopted a scheme whereby the modules are put in directories called Mod0, Mod1, Mod2, and so on. This allowed us to use the directory name for the module reference. The next database table column contains a user-defined name for the question. A third column is a "memo" field that contains the question itself. It can include standard HTML tags plus the new tags `<anchor>` and `</anchor>`. A fourth column contains the answer. Included in each module page are two functions. The first sets a variable equal to the current directory. The second is a Javascript function poppy that generates pop-up windows. This last function end with the statement of the form `newwin.focus()` that gives focus to the window named newwin after it is generated.

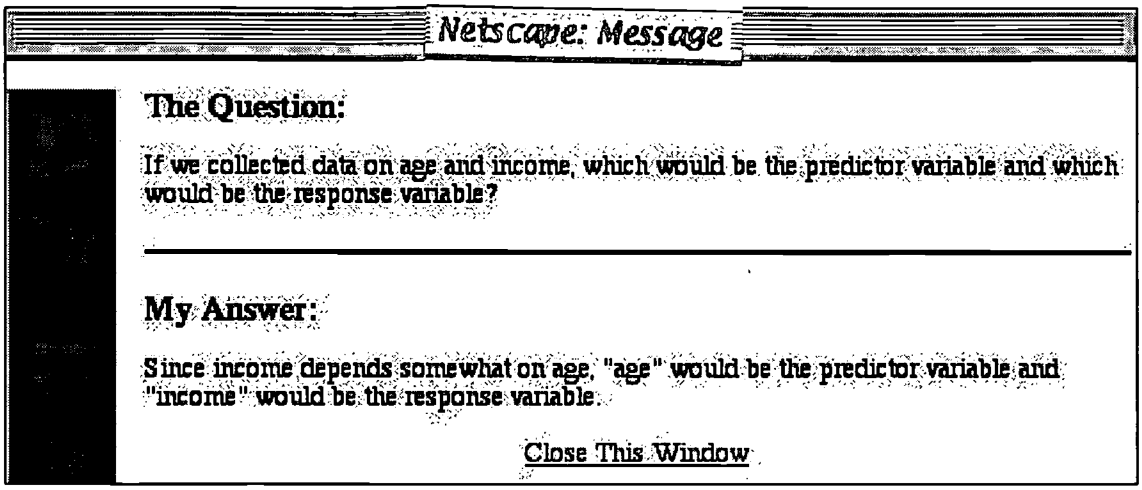

Figure 4: Portion of a Standard Pop-up Window

When the module page is generated, an SQL query seeks all sets of questions and answers associated to the directory in which the page resides. The Cold Fusion server then loops through the results of this query. For each record, a series of commands parses out the phony `<anchor>` and `</anchor>` tags from the questions to make three strings: The text between before <anchor> tag, the text between `<anchor>` and `</anchor>`, and the text following the `</anchor>` tag. The following code is then sent to the Cold Fusion server:

```
<cfoutput>
      <script language="Javascript">
        questionstrings["#QName#"] = "#qstart#"+'
          <a href="Javascript:poppy(questions.#QName#,answers.#QName#)">' +
          "#qanchor#"+"</a>" + "#qend#";
        questions["#QName#"] = "#qstart#"+"#qanchor#"+"#qend#";
        answers["#QName#"] = "#qanswer#";
      </script>
</cfoutput>
```

When the HTML page is generated, the client browser sees the Javascript code with the variables like `#qsatart#` replaced by strings read in and parsed from the database. This generates a local array `questionstrings[ ]` of strings of HTML code for questions with the portion between the original <anchor> and </anchor> tags appearing as a links calling the function poppy. The arguments of poppy are elements of the Javascript arrays `questions[ ]` and `answers[ ]`. These arrays were generated by the above Cold Fusion code. In the array `questions[ ],` the phony tags have simply been removed. Finally we in include another Javascript function, `insertquestion`:

```
<script language="Javascript">
      function insertquestion(qname){
        obj = eval("questionstrings."+qname)
        document.write(obj);
}
</script>
```

All of this is done via a single Cold Fusion include statement in the header portion of each page. The effect is realized when an author puts the following single line of code into the content portion of a module page:

```
<script> insertquestion("my_question") </script>
```

In the page is delivered to the user's browser, what will appear is the text of the question "`my_question`" with a portion appearing as a link. Clicking on the link will pop up a window displaying both the question and the answer. An author can edit the text of the question and answer anytime via a Web interface that allows editing of database fields.

Conclusion

There is much we have not discussed in this paper. Some interesting features have been left untouched and we have not discussed issues such as the development process. In that regard, we encountered and continue to encounter some typical stumbling blocks. The most insidious of these is the "Catch 22" where designers feel they cannot start designing and programming until they have seen all of the content and authors feel they cannot begin to write content until they are familiar with the environment in which it is to be displayed.
Probability Park is currently being used by about fifty in-service and fifteen pre-service teachers. Currently we have insufficient feedback and no results on which to base a study of its effectiveness. We have therefore focused on explaining "what", "why", and "how" with the idea of illustrating how we have used technological means to achieve pedagogic ends and to create a model for meeting increased demands for professional development. We believe our ideas and design have a lot to offer and can be built upon in the future.

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Improving Computer Literacy Skills of College Faculty: Tips and Techniques

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There is a growing demand in the schools that new teachers be computer literate: they are expected not only to possess a working knowledge of computers but also to use computers effectively in their teaching. These expectations have pressured university faculty to increase the use of technology in methods courses and to model how technology can enhance instruction.

While teacher certification programs are attempting to respond to these pressures, many obstacles exist that impede the use of technology in methods courses. For instance, some institutions lack computers for faculty use or possess antiquated machines that provide minimum functionality. In addition, even when modern equipment is available, many faculty lack the basic skills to use that equipment. Faculty often acknowledge the need to be technology literate themselves before they can begin the process of incorporating technology into their classes.

At one large urban university, recent state initiatives have provided every School of Education faculty member with a modern computer. The arrival of these machines has increased the demand for technology assistance, and a realization that scarce resources exist that can provide hands-on support and training.

This roundtable will discuss various strategies, their effectiveness, and lessons learned as one university experiments with methods to provide faculty opportunities to improve their computer literacy skills. These strategies and discoveries include:

- Appointing one faculty member as "technology liaison" whom faculty were encouraged to contact for assistance, and the realization that demands for individual support far outweigh the amount of time one individual could offer;

- The development of a weekly technology faculty development course and scheduling strategies and incentives that encourage faculty to attend;

- The realization that when faculty learn to use software that improves their own personal productivity, they are indirectly motivated to explore other aspects of technology;

- Developing strategies for providing a course that accommodates faculty at different technology levels;

- Devising ways of dealing with faculty whom exhibit high levels of computer anxiety.

This roundtable presentation will allow personnel responsible for providing technology assistance to faculty a chance to exchange ideas, methods, and resources.

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University Faculty Phobias: Investigating Technology Apprehension

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Abstract: Working with university faculty to improve computer literacy and technological competencies is a challenging process. Identifying varied technological knowledge and skills of education faculty coupled with the perceived needs or lack of needs of individual members requires a comprehensive assessment prior to the formation of the faculty development plan. In our present technological environment a full spectrum of competencies are recognizable. Some in the professorate have attained skill levels that are quite remarkable through self-teaching and occasional voluntary workshop attendance. Unfortunately, these self-starters, hailing from a variety of content specializations in education, are in the minority. This study has been designed to identify the characteristics of all education faculty members towards the use of technologies. The results of such studies will aid administrations with necessary information to help their institutions identify linkages between the technological characteristics of faculty members and perceived institutional barriers to technology use.

Introduction

College and university instructors have experimented with technologies for decades. However, the typical college professor still teaches in the manner of academicians dating back hundreds of years (Daggett, 1994). It has been observed during the last decade that many in the professorate have resisted utilizing computer technologies for improved professional performance as well as enhancement of instruction in the university classroom. Weber (1996) identified that students are accurately aware of the deficient use of technologies in classrooms. Of the 13 categories of technology use barriers identified by them, seven of the categories specifically addressed classroom performance concerns: (a) inadequate classroom instruction; (b) instruction confusion; (c) inadequate computer lab instruction; (d) no connection to the field of study; (e) inadequate modeling by the instructor; (f) inadequate hands-on learning; and (g) lack of technology in the curriculum. Unfortunately, there is growing concern that as some faculty sit back and continue to evaluate or completely resist the new technologies now being purchased by many universities, students will fall further behind in today's highly technological society.

The U. S. Congress Report (1995) on Technology in education revealed the lack of preparation experiences in colleges of education. Many in the technology field concur that the majority of instructors in all educational settings are not as computer literate as necessary for the extraordinary opportunities technological innovations provide in the teaching and learning continuum. In an attempt to identify the problem George, & Camrarta (1996), posit "The cyberanxious instructor who seeks isolation from the group is not rejecting the learning or even the technology, but rather is more likely attempting to avoid the scrutiny and possible disapproval of peers and students alike" (p. 49). Sullivan & Keating (1997) concluded from their study of veteran public school teachers that the entire educational staff needs continuous training so they will be "up-to-date" with the latest technologies and that the training of principals as well as teachers, should be developed in university preparation programs.

In order to address those concerns, the professorate must become the model from which undergraduate and graduate learners will become aware of the possibilities of the use of technological innovations. It is apparent numerous administrators in higher education institutions would like to know how to encourage faculty to use technology more

appropriately in teaching, research, and service to the university and surrounding communities. This study provides those in administration with a new method of evaluating faculty competence and self-efficacy using technologies. The development of the "Technology Use Questionnaire" used in this study could provide the means through which those in higher education administration may identify barriers in each department, college, and university unit with respect to technological literacy. The instrument may also provide a means through which administrators could identify the perceived institutional structural and organizational barriers to successful technology integration.

Research Questions

The research questions of the study were:

1. Are there characteristics in higher education faculty members that identify some faculty members as being more likely to use technology than others?
2. Are there discernable patterns of perceived or real institutional organizational/structural impediments to technology usage in higher education?
3. Are there linkages between the type of faculty member and their perceptions or identification of institutional barriers to technology use.

Purpose

The purpose of the study was to survey faculty and administrators at two universities in order to identify linkages among types of technology literate faculty and structural/organizational barriers to their using technology. An instrument has been developed that can be used by administrative personnel to assess faculty at their institutions for a proactive plan of change. By identifying faculty groups and institutional organization/structural barriers, interventions can be targeted to each type of faculty based on the characteristics of that type. There is a need for university faculty to recognize and understand that problems exist and that these problems can be identified and remedied through organizational restructuring and programmed planning.

Methodology

Participants

The sample included a total of 300 full-time and part-time faculty members in the colleges of education at two regional, comprehensive, doctoral-granting institutions of higher education. University one has an enrollment of approximately 20,000, 55% of which were female and 45% male. It has one 850-acre barrier-free campus with 84% of full-time faculty members having doctoral/terminal/first professional degrees. University two has an enrollment of approximately 20,000, 60% of which were female and 40% male. This university is developing as a distributed university of 5 campuses which are geographically dispersed across seven counties. Ninety percent of full-time faculty members have doctoral/terminal/first degrees. Both institutions have college of education laboratory schools.

Instrumentation

A questionnaire has been designed by the researchers to identify institutional organizational and structural barriers to technology usage. It is divided into three sections. The first section includes a number of demographic questions including gender, age, department, academic rank, years as a professor, years employed at the institution, and years at their current rank. A pilot study was conducted at university two using selected faculty. The purposes of the pilot study were to: (a) test the questionnaire items in the instrument for item validity and reliability; (b) to enable the researchers to observe respondent and instrument responsiveness; and (c) and to obtain direct comments from respondents about clarity of questionnaire items, instrument length, and clarity of the directions.

Data Collection

Data were collected using the "Technology Use Questionnaire" which was administered in early February, 1999, to all identified faculty members and administrators at the two universities. Participants had a choice of how to complete the survey using either paper and pencil or the Internet. A cover letter, which is part of the actual survey

and an envelope for return mailing accompanied each paper survey. The survey was also be posted on the Internet. A reminder notice was sent two weeks after the initial mailing. This reminder notice did not include a survey. A final mailing, which included a survey, was resent two weeks after the reminder notice.

Data Analysis

Survey items were designed to answer the three research questions. A Microsoft Access for Windows 95 database was designed to improve the reliability and ease of entering and organizing the data from the completed surveys. SPSS for Windows v. 8.0 was used to statistically analyze the collected data. The .05 level was used to determine statistical significance.

Results

For the purposes of this presentation, the results from the pilot study and preliminary data analysis are included. The instrumentation and research methodology will also be presented.

Implications

The researchers fully expect to find: (a) characteristics that identify some faculty members as being more likely to use technology than others; (b) discernable patterns of institutional organization/structural impediments to technology usage in higher education; and (c) linkages between the type of faculty member and their perceptions or identification of the institutional barriers to technology use, the implications are three fold. First, the research demonstrates that the theory of a multi-group technology literate faculty typology exists and can be identified. Second, the researchers have created an instrument that can be used by administrative personnel to assess faculty at their institutions for a proactive plan of change. If a university recognizes there are structural and organizational problems and can readily identify those problems, programmed planning can be implemented. Finally, if the researchers' theories are not supported by the data, then there would be no systematic relationship between types of faculty and organizational/structural barriers. Faculty's use of technology would be based on factors other than those structural or organizational barriers identified in this study.

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We Can Do This: Graduate Students Perspectives on Mentoring Faculty Technology Integration

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The call for teacher educators to integrate technology into preservice teacher education is not new. In 1986 Blackhurst and MacArthur found that special education faculty who were preparing teachers for the K-12 environment lacked the skills and knowledge to teach their students about technology. Similarly, over the past decade, researchers (Hasselbring, 1991; Office of Technology Assessment (OTA), 1995; Sheingold & Hadley, 1993; Wetzel, 1993) have argued that preservice technology training must become a priority if we are to have teachers who are both comfortable and competent with the respect to the use of technology in their teaching (OTA, 1995).

The infusion of technology into pre-service teacher education should be a major priority for teacher education programs across the country; especially in the area of special education where technology integration can be beneficial to student development (Schmidt, Weinstein, Niemic, & Walberg, 1986). This presentation features a faculty technology training program that utilized components from the Iowa State University model (Beisser, Kurth, & Reinhart, 1997; Fox, Thompson, & Chan, 1996; Thompson, Hanson, & Reinhart, 1996; Thompson & Schmidt, 1994). In an attempt to extend this model, we created a training program that featured the use of special education graduate students. Our study examined whether students with limited technology expertise would have the ability to assist faculty members in their integration of technology into the classroom teaching.

Utilizing Joyce and Showers (1995) theory-demonstration-practice-feedback-coaching model, special education graduate students-with limited technology experience (i.e., word processing)-instructed special education faculty members in ways to integrate technology into their method and educational foundation courses. Through weekly on-line journals and pre- and post interviews, we were able to ascertain the effectiveness of this training program.

This presentation will report these findings from the graduate student perspective. More importantly, this presentation will share preliminary findings about the mentoring relationships that grew between graduate students and faculty members due to the training interaction. Our hope is to share this data with participants and discuss further ways to enhance the integration of technology through graduate student/faculty mentorship.

We hope that participants will:

- understand the necessary components in effective technology training for faculty members in preservice teacher education programs;
- discuss the benefits of the theory-demonstration-practice-feedback-coaching model;
- learn how graduate students can be effective mentors in the faculty integration process;
- gain an understanding of the benefits of graduate student mentoring; and
- discuss the positives and negatives involved with technology training through graduate students.

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Retooling Higher Education Faculty Through Multidisciplinary Technology Teams

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Abstract: This roundtable discusses observations from an innovative multidisciplinary collaborative instructional model used over the past three semesters at the Johns Hopkins University in the Technology for Educators Graduate Program. The approach has been successfully applied to develop graduate level technology courses for classroom teachers while at the same time providing opportunities for professional development of technology skills for teacher education faculty. The courses have begun to attract attention from local industrial training groups as well.

Introduction

Objectives of the roundtable include the following:

- Identify and describe conceptual frameworks for cross-disciplinary collaboration and how these impact the traditional university teaching/learning process;
- Determine factors that relate to the effectiveness and success of such collaborations;
- Provide a forum for discussion of emerging issues in the context of technology-supported collaborations.

Johns Hopkins Technology for Educators program offers both masters degree and graduate certificate programs designed for classroom teachers. Three courses within this program have been selected to augment and amplify traditional instructional approaches by teaming university faculty with highly qualified and experienced technology professionals. The synergy of this approach yields expanded development of technology skills for the faculty member and expanded development of teaching skills for the technologists.

An unexpected effect has been the attraction of the program to instructional design professionals in training departments of local technology firms. Although these professionals are not K-12 classroom teachers, they have become interested in the learning sciences through their work. They seek greater understanding of pedagogical approaches to improve learner motivation, accelerate comprehension and improve retention of knowledge within the courses they produce. These students from industry are often highly skilled and experienced with the multimedia tools needed for electronic instruction, and are experienced in working as part of a multidisciplinary instructional teams. Having them work alongside K-12 classroom teachers is proving to be serendipitous to both teachers and technologists as evidenced in the individual and group projects produced in the courses (Davenport & Prusak, 1998).

These courses provide the graduate students with experience in the team development process through participation in group projects which yield technology-based instructional modules. A CD-ROM containing examples of the modules created in the Technology for Educators courses is produced at the end of each semester.

The specific courses used as the basis for discussion in this session are:

- Course # 893.645 Electronic Coaching and Instruction on the Internet
- Course # 893.563 Multimedia Tools for Instruction
- Course # 893.542 Educational Uses of Telecommunications

The instructional staff brings together a multidisciplinary team with a diverse background of instructional and technology skills in three diverse skill areas: high-technology applications, constructivist multimedia design, and adult education teaching strategies. The collaborative model uses a project-based learning-centered approach to enhance the interactive, communal character of learning and to engage learners in productive inquiry.

The instructional team has also collaborated on a number of prior projects in the federal, corporate and academic environments. Linda Tsantis is a highly experienced teacher educator and coordinator of the Technology for Educators program at Johns Hopkins University. Associate faculty Suzanne Thouvenelle is an executive and director of research at MOBIUS Corporation which produces multimedia software that supports constructivist learning experiences in early childhood environments. Dave Keefe is a computer scientist and consultant who produces instructional technology content for graduate programs at Johns Hopkins University, George Mason University, and education associations in the Washington, DC area.

Overall Program Structure and Approach

Instructional design draws heavily on Vygotsky's concept of "scaffolding" as a means of leading students to rapid attainment of difficult subject matter, to the concepts of coaching and "Socratic Coaching" espoused by Kimball and Mareen Duncan Fisher in "The Distributed Mind" (Fisher & Duncan-Fisher, 1998). Concepts of "Agile Learning" used by innovative team-oriented projects within high tech corporations to develop knowledge teams who are skilled in "learning how to learn." (Tapscott, 1998). The instructional staff models the desired behavior through their instructional interactions with the graduate students. Students are encouraged to keep journals of their questions and experiences in the belief that "better questions focus on where information can be found or on teaching particular thinking processes that help learners make good decisions." (Fisher & Duncan-Fisher, 1998). Students participate in the design of rubrics that are used for group assessment of their projects. The rubrics are also used within their projects for the assessment of instructional effectiveness for end users.

The course "Online Coaching and Instruction on the Internet" is designed to prepare graduate teachers to operate as coaches and mentors within their school districts, and uses a constructivist learn by doing approach. The students are coached while they learn the skills they will be applying, and mentored to consider broader implications of these skills on their future careers. Asynchronous and synchronous online discussion forums are used heavily within this course, which also makes frequent use of remotely located "guest mentors" (DeHalluin et al, 1996).

The course "Multimedia Tools for Instruction" uses Microsoft PowerPoint 97® as a vehicle for illustrating the process of integrating technology into instructional modules. The course instructors model this process by using PowerPoint within class modules on text, graphics, image, audio and video media (Agnew et al, 1996) and the students also use the platform for their group and individual projects. Students are also exposed to a variety of other authoring platforms, including Hyperstudio®, Director®, AuthorWare® and Podium® (Hofstetter & Fox, 1997). Ethical and social implications are explored through group discussions (Tapscott, 1998)... for example a discussion on "reality and identity" referencing Sherry Turkle's "Life on the Screen" (Turkel, 1997) was produced and delivered to the class using a video connection on InternetPhone from the Epcot Center at Disney World

The course "Educational Uses of Telecommunications" introduces students to Distance Learning and Distributed Learning (Dede, 1996) concepts including the conversion of instructional material for presentation on the Web (Borkowski et al, 1996). Web browser enhancements and plugins to enable presentation of data in visual, audio and

other forms are reviewed and applied in class where relevant (for example in classes that use "white boards" to communicate with remote instructors") (Collis et al, 1996). The course examines a number of commercially available training modules on the Web (Fisher & Duncan-Fisher, 1998) and contrasts the "one size fits most" design philosophy of many of these approaches to those that identify where individual learning style differences are, or are not, accommodated. Evolving techniques in data mining for consumer applications (Tsantis & Keefe, 1996) are contrasted with the data sources needed for effective application of these techniques to customize instructional environments to individual learner needs. Students report on their class project in the form of a Website that they develop.

Conclusion

Three courses in the Technology for Educators Graduate Program at Johns Hopkins University frame the approach for a multidisciplinary collaborative instructional model to serve both K-12 classroom teachers and training professionals from industry. Early indicators suggest that both groups benefit from the cross-fertilization of skills, experiences and perspectives in a project-based program.

The 1990s trend of corporate "right-sizing" to buy out experienced technical professionals, to both achieve down sized work forces while creating room for new (and lower-paid) staff, has created a pool of workers who could potentially ease some of the teaching crises facing the nation.

Skilled technologists serving as para-educators in partnership with K-12 teachers could provide significant improvements to science and technology education in the United States. Our program at Hopkins is at an early stage... we are most interested in using this roundtable session, as an opportunity for discussion with other educators who share this interest and/or are experimenting with multidisciplinary programs at their schools or universities. In particular we are interested in components of the models that they are currently employing for the effective and meaningful integration of technology in teacher preparation programs.

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A Model Professional Development Project: Intentional And Incidental Benefits For Faculty And Students

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Abstract: A professional development project aimed at introducing and diffusing an interactive multimedia courseware (ICW) authoring tool, the Experimental Advanced Instructional Design Advisor (XAIDA), on community college campuses across the state of Texas is in its third year of funding. Evaluation research has played a major role in determining the success of the project. Nineteen community college instructors and over 200 students have participated in evaluating the introduction phase of the project. Evaluation results from a wide range of disciplines have demonstrated the ease with which instructors can develop ICW using XAIDA and the instructional effectiveness and efficiency of instructor-developed ICW. Currently, the project is aimed at demonstrating that the Internet is a viable platform for diffusing XAIDA technology to college campuses statewide. Project results revealing intentional and incidental benefits for both faculty and students are discussed in this paper.

Introduction

Bringing college campuses up to speed with available instructional technology is a challenging effort. There are several obstacles to overcome in meeting the challenge. The obstacles range from gaps in information about technology that is currently available, high instructor workload, restricted computer resources, and organizational cultures that continue to embrace traditional approaches to education and ignore the value of innovative approaches (Parker, 1997; Roberts & Ferris, 1994; Sherry, Lawyer-Brook, & Black, 1997). Granted, there are pockets of instructional technology emerging on college campuses. The pockets of technology are the result of either an instructor taking the initiative or project funding to support the technology. A "grass roots" initiative is assuredly more successful than forcing technology on users. Forcing technology on uses is more an assurance of failure than success, as people are resistant to change, especially when it requires the transformation of basic assumptions about the world around them (Wenzel, 1993).

The Alamo Community College District currently monitors a professional development project intent on creating pockets of instructional technology on college campuses. The Texas Higher Education Coordinating Board under Carl Perkins Vocational and Applied Technology Education Act of 1990 has funded the project for the past three years. The project's aim is to introduce and diffuse an interactive multimedia courseware (ICW) authoring tool on community college campuses across the state of Texas. The authoring tool has been the key to the success of the project. The tool, the Experimental Advanced Instructional Design Advisor (XAIDA), developed under the sponsorship of the Air Force Research Laboratory, provides an easy to learn and cost-efficient authoring environment for the rapid development of ICW (see Hsieh, Halff, & Redfield, 1998). XAIDA was designed specifically for subject matter experts, namely instructors, with minimal computer skills who are inexperienced in instructional design and ICW development.

XAIDA is a knowledge-based generative system. XAIDA automatically generates ICW with adaptive practice exercises from domain knowledge and multimedia input by the developer. Instructional design theory is built in the system and is transparent to developers, thus relieving them of the burden of instructional design. These

generative features not only increase ICW development efficiency they also bring ICW development within reach of college faculty and staff.

Goals of the professional development project have been to demonstrate (1) the ease with which community college instructors can develop ICW using XAIDA, (2) the instructional effectiveness and efficiency of instructor-developed ICW, and (3) the utility of the Internet as a distribution platform to diffuse the technology statewide. Evaluation research has played a major role in the professional development project. Research results have provided a means of assessing progress toward the aforementioned goals. Results from evaluations conducted on the *introduction* phase of the project have revealed incidental as well as intentional benefits, as described in the goals, for both faculty and students. Results gathered from the project thus far are presented following a brief description of XAIDA.

Description of the Experimental Advanced Instructional Design Advisor (XAIDA)

XAIDA is an instructional system, developed under the sponsorship of the Air Force Armstrong Laboratory to explore techniques for automatically generating ICW (see Hsieh, Halff, and Redfield 1998). XAIDA consists of a program called *Develop* for entering and editing lesson topic descriptions and a program called *Deliver* for presenting instruction on the topic. *Develop* is a knowledge acquisition system that provides a subject-matter expert, in this case a community college instructor, with facilities for inputting and storing domain specific knowledge. XAIDA stores the knowledge in a database file. *Deliver* opens the database file and monitors instructional interactions between the student and the knowledge base. *Deliver* provides students with an overview of the subject matter, a detailed presentation of lesson material, selective review, and adaptive practice exercises.

Deliver dynamically constructs each practice exercise from the knowledge base. Developers need only specify facts that the student is to master. Practice is generated under the control of a miniature Intelligent Tutoring System (ITS). The ITS maintains a model of the student and tracks facts that she appears to have mastered and any *misconceptions* that she has exhibited. The tutor generates exercises that tend to address unknown facts and misconceptions. Practice is fully supported--students can answer on their own, return to the lesson to look up an answer, ask the system to provide an answer, or skip the exercise.

Description of the Project

Twenty-three instructors and over 200 students on 13 community college campuses across Texas have participated in the project. The main goal of the first year of the project was to introduce XAIDA on community college campus across the state of Texas. To achieve the goal, the project was designed to (a) train a cadre of community college instructors to develop courseware with XAIDA and (b) evaluate the instructional effectiveness of the instructor-developed courseware in the classroom.

The goals of the second year of the project were to continue to facilitate the introduction of XAIDA and begin diffusion of the technology. To accomplish this, the project was designed to (a) expand its scope, (b) teach new instructors how to develop ICW with XAIDA, (c) continue to verify the instructional effectiveness and efficiency of instructor-developed ICW, (d) develop a "train-the-trainer" element to facilitate diffusion of the technology, and (e) transfer the technology to the college campuses.

The goals of the third year of the project are to (a) create a core of college instructors adept at developing ICW with XAIDA, (b) maintain "quality assurance" of instructor-developed courseware, (c) diffuse the technology through use of the Internet as a distribution platform, and (d) expand educators' knowledge of the benefits of ICW.

Throughout the life of the project instructors' and students' knowledge, skills, abilities, and attitudes have been measured. Workshops that teach instructors how to use XAIDA have been designed to include evaluation measures. Initial use of the instructor-developed courseware in the classroom has been designed to include evaluation. Refinements continue to be made to the evaluation procedures and measures developed specifically for the project. Results from the evaluation of the workshops and classroom use of the courseware are presented next.

Instructor's Introduction to XAIDA Develop

Participating instructors represented a board range of academic disciplines (see Table 1). Each instructor was required to (a) attend a training workshop to learn how to develop interactive multimedia courseware using

XAIDA, (b) develop at least one lesson using XAIDA, (c) use the courseware in their classrooms for purposes of evaluating its instructional effectiveness. Instructors were paid a stipend for participating.

Year 1		Year 2		Year 3	
Institution	Department	Institution	Department	Institution	Department
Lee College, Baytown	Pipe Fitting	Amarillo College, Amarillo	Computer Information Systems	Amarillo College, Amarillo	Computer Information Systems
Navarro College, Corsicana	Math	Brookhaven College	Computer Science	El Paso Community College, El Paso	Nursing
Odessa College, Odessa	Oil Well Driling	El Paso Community College, El Paso	Nursing	Houston Community College, Houston	AC/Refrigeration
South Texas Community College, McAllen	Computer Electronics	Navarro College, Corsicana	Math	Odessa College, Odessa	Occupational Safety & Health
St. Philip's College, San Antonio	Instructional Technology	Odessa College, Odessa	Occupational Safety & Health	South Plains College, Lubbock	Electronics
Temple College,Temple	Computers	South Plains College, Lubbock	Marketing/Management	South Texas Community College, McAllen	AC/Refrigeration
Texas State Technical College, Marshall	Physics	South Texas Junior College, Uvalde	Nursing	South Texas Junior College, Uvalde	Math
		St. Philip's College, San Antonio	Instructional Technology	St. Philip'sCollege, SW Campus	Aircraft Maintenance
		St. Philip'sCollege, SW Campus	Aircraft Maintenance	Tomball College, Tomball	Technical Writing
		Tomball College, Tomball	Technical Writing		

Table 1. Participating Community College and Discipline Represented within a Project Year

Year one of the project involved seven instructors from seven different campuses. They attended a single 3-day XAIDA workshop. The objective of the workshop was to teach them how to develop courseware with XAIDA and actually produce classroom-ready courseware for evaluation. Prior to evaluating their courseware in their classrooms, instructors were given half-day refresher training on XAIDA. One hundred and eleven students participated in the classroom evaluations.

Nine new instructors and two returning instructors from ten campuses completed two 3-day XAIDA workshops provided during the second year of the project. The second workshop also taught instructors how to create multimedia for their courseware. Each instructor was required to train a colleague, at his or her respective campus, to develop ICW with XAIDA. One hundred seventeen students participated in the classroom evaluations of the courseware produced the second year of the project.

Four new instructors and five returning instructors from nine different campuses completed the first 3-day workshop offered during the third year of the project. A second workshop is scheduled to teach the instructors how to upload their XAIDA courseware to a Website. An instructor other than the developer will download the courseware for classroom use and evaluation, during the diffusion phase of the project.

XAIDA Training Workshops

Instructors were surveyed to determine how regularly they use computers and their level of familiarity with a variety of software applications prior to attending the XAIDA workshop. Results from the survey (see Table 2) were used in the design of the workshops. Familiarity with a Windows environment and Paint application is advantageous to learning XAIDA, but not necessary. The staff conducting the workshops was prepared for all levels of computer skills.

Familiar with Software and Regularly Use a Computer	Year 1 Percent Agree (n = 5)	Year 2 Percent Agree (n = 6)	Year 3 Percent Agree (n = 6)
Microsoft Word	80	70	67
Windows Operating System	100	54	67
Power Point	60	30	50
Paint Brush	20	25	50
Authorware®	0	8	0
Use computer at home	80	62	67
Use computer at work	100	77	78

Table 2. Percentage of Participants Reporting Familiarity with Software Applications and Regular Use of Computers

Each workshop was conducted in an open learning environment and was hands-on intensive. The workshop design conformed to a minimalist training approach, where time spent reading the user manual was left to the

discretion of each instructor. The workshop objectives were--be able to select an appropriate courseware topic and be able to use XAIDA effectively and efficiently to develop ICW. The second year of the project the workshop objective included—be able to create multimedia (e.g., graphics, audio, and video) for use in the courseware.

Training and evaluation protocol for a 3-day workshop began with pre-training assessment, followed by an introductory presentation of XAIDA and platform demonstration of Deliver. Participants began by using Deliver before learning about Develop. Their first exposure to Develop was a demonstration of the editors. Before the end of Day 1, they began a step-by-step paper-based tutorial to develop courseware they had viewed in Deliver. Day 2 began with a plenary review of the Develop editors. The remainder of the workshop was spent developing courseware on topics relevant to each individual instructor. Observations were made throughout the workshops on changes in participants' abilities to develop ICW with XAIDA and their level of acceptance of the technology.

Workshop Evaluation Results

Measures were taken of instructor self-rated proficiency using XAIDA (see Figure 1), skills using computers in general, and attitudes toward XAIDA. The most direct evidence that the workshop objectives were achieved is the 23 XAIDA lessons developed during the workshops.

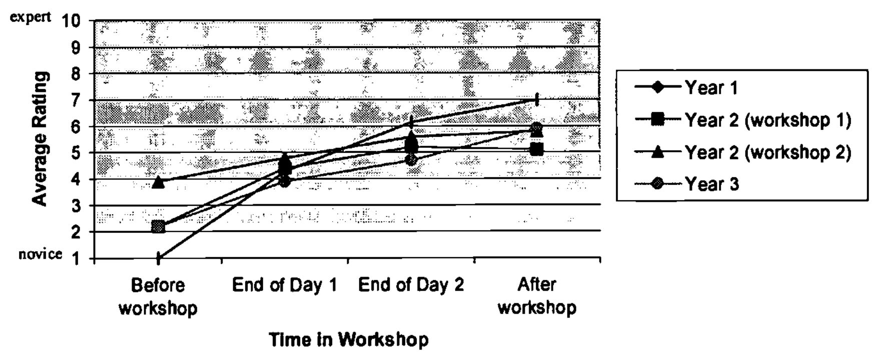

Figure 1. Instructors' Average Self-ratings of Proficiency Using XAIDA *Develop* across Workshop Days

Instructors rated their proficiency using XAIDA *Develop* on a 10-point scale where "1" represented a *novice* user and "10" represented an *expert* user. Significant increases in perceived levels of proficiency were found at the end of the first two days of the workshop, regardless of the project year. The first two days of a workshop were spent learning new skills. At the end of the final day of training, however, no significant increases in proficiency were reported for years 2 and 3. The final day of the workshop for these two groups was spent introducing new strategies for developing courseware with little time to practice. The total increase in proficiency self-ratings was found to be statistically significant across all three years of the project (Year 1: Before $\underline{M} = 1.0$, After $\underline{M} = 7.0$, $\underline{t}(7)=12.8$, $\underline{p} < .0001$; Year 2: Before $\underline{M} = 1.8$, After $\underline{M} = 5.8$, $\underline{t}(8)=5.7$, $\underline{p} < .0001$; Year 3: Before $\underline{M} = 2.1$, After $\underline{M} = 5.9$, $\underline{t}(9)=8.1$, $\underline{p} < .0001$). Self-perceived computer skills, including newly acquired skills using *Deliver*, were rated on a four-point scale labeled as (1) *none*, (2) *fair*, (3) *good*, and (4) *expert*. Skill using *Deliver* was rated significantly higher after the workshops than before (Year 1: Before $\underline{M} = 1.0$, After $\underline{M} = 3.0$, $\underline{t}(6)=9.1$, $\underline{p} < .0001$; Year 2: Before $\underline{M} = 1.6$, After $\underline{M} = 2.6$, $\underline{t}(8)=3.7$, $\underline{p} < .003$; Year 3: Before $\underline{M} = 1.6$, After $\underline{M} = 2.8$, $\underline{t}(8)=5.5$, $\underline{p} < .0005$). Instructors from year 2 rated general computer skills relevant to courseware development, such as creating graphics, using a scanner, managing files and directories, significantly higher after the workshop than before.

Acceptance and willingness of the instructors to adopt XAIDA was imperative to the success of the project and integrating the new technology. Therefore, an exploration was made of instructors' attitudes toward XAIDA. An open-ended item asking for impressions of XAIDA was used to assess attitudes before the workshop and at the end of each workshop day. Comments were coded into seven categories found to reflect users' concerns when adopting educational innovations (Hall, 1979; Bailey & Palsha, 1992). Users who become accepting of an innovation tend to express positive concerns that fall into the higher categories—*management*, *consequences*, *collaboration*, and *refocusing*. Comments were further coded as positive, negative, and neutral statements. The seven categories and examples of coding criteria follow:

1. *Awareness*-- have or have not heard of it, interested in the area;
2. *Information*-- limited knowledge about it, what are the possible applications;
3. *Personal*-- effects on professional status, how my tasks will change;

4. *Management*-- coordination of tasks and people, conflict between interests and responsibilities;
5. *Consequences*-- how it affects classroom training, its application to training;
6. *Collaboration* --coordinating efforts with others, help others with the innovation; and
7. *Refocusing*--revise the approach, modify based on use.

Similar patterns of concerns were found across the project years. Increased acceptance of the technology was found early in the workshop for subsequent years with the return of participating instructors. The portion of comments categorized as *management*, *consequences*, *collaboration*, and *refocusing* helps to discriminate groups of early adopters from late adopters. Before their respective workshops began, 0 percent of year 1 participants expressed high level concerns, 7 percent of year 2 participants expressed high level concerns, and 36 percent of year 3 participants expressed high level concerns. After the workshops, 67 percent of year 1 participants expressed high level concerns, 60 percent of year 2 participants expressed high level concerns, and 71 percent of year 3 participants expressed high level concerns. The majority of comments made the last day of the workshops across the three years of the project have been positive (Year 1: 78% positive, Year 2: 84% positive, Year 3: 78% positive). An increase in negative comments at the end of the second day of the workshop has been a consistent pattern across project years. The second day of the workshop was spent developing courseware that is within the expert domain of the instructor. Developing ICW with XAIDA required participants to think differently about their subject matter. XAIDA required them to think about their courseware topic in terms of *what they teach* instead of *how it is taught*. This cognitive shift could account for the temporary increase in negative comments.

Students' Introduction to XAIDA *Deliver*

Fourteen XAIDA lessons were evaluated in the field. Over 200 community college students on 12 campuses participated in the evaluations. In-depth descriptions of all evaluation sites and courseware are beyond the scope of this paper. Therefore, the results will be presented in a combined form. Minimum computer requirements, 486 66 MHz with Windows 95 operating system, for running XAIDA *Deliver* were met at all college campuses. The majority of field tests of the instructor-developed courseware involved implementing the courseware as part of an ongoing course curriculum. Instructional effectiveness of the XAIDA courseware was evaluated on three fronts—how much the students learned, efficiency with which they learned, and how they reacted to the learning experience.

We expected differences between post-and pre-instruction achievement scores to be greater than zero. Average time to complete the courseware was expected to be less than a nominal class period. We also expected more students to express preferences for computer-based instruction after participating in the evaluation compared to before participating.

Classroom Evaluation Results

Figure 2 shows the results from written achievement tests administered before and after the courseware was completed. As expected increases in students' achievement test scores were found to be statistically significant across all classroom evaluations. Increases in test scores ranged from 8 to 125 percent (M = 72.6).

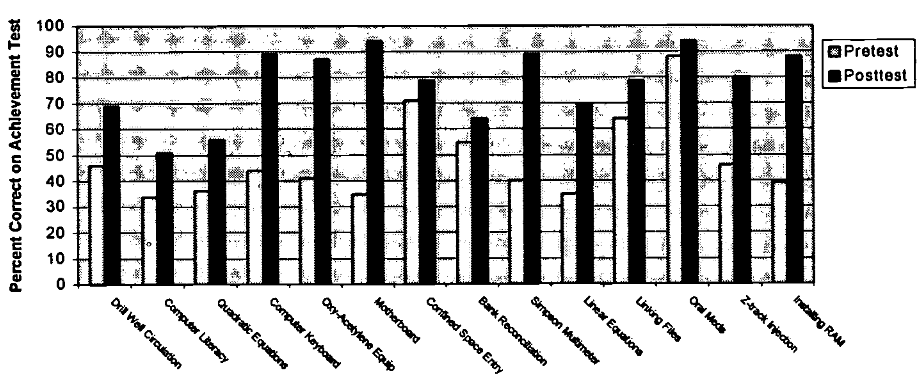

Figure 2. Percent Correct on Written Achievement Tests Administered Before and After the Courseware.

It took students on average 27.1 minutes to complete the courseware implemented and evaluated as stand-alone instruction, during the second the year of the project. The average completion times ranged from 16.1 to 36.4 minutes. The courseware produced nearly a 50 percent saving in class time.

Before participating in the evaluation, 61.8 percent of the one hundred-seventeen community college students participating in year 2 of the project reported being "comfortable using computers." After their participation, 75.3 percent of students reported being "comfortable using computers." The 13.5 percent increase in comfort was significant ($t(116) = 1.9$, $p < .05$). Of real interest is the shift in instructional preferences expressed by the 117 students. Seventy-three percent of the students expressed a preference for computer-based instruction over traditional classroom instruction, after they experienced ICW. There is a noticeable shift in preferences toward self-paced CBI. After participating in the evaluation 55 percent of students showed a preference for self-paced CBI; whereas, before the evaluation only 40 percent of students showed the same preference.

Discussion

The professional development project is realizing the intended benefits of its goals which are: (a) statewide use of instructional technology in community college learning environments, (b) creation of a cadre of courseware developers from varying disciplines (e.g., mathematics, computer information systems, management, occupational safety and health, instructional technology), and (c) a corpus of on demand ICW available on the Internet at http://www.accd.edu/accd/workdev/workdev.htm. An emergence of incidental benefits from the project include (a) consistent results showing instructor-developed ICW to be instructionally effective and efficient, (b) wide acceptance by students of instructional technology in the classroom, (c) an expressed preference by students for computer-based instruction. (d) improvements in instructors' general computer skills, and (e) recognition that informational needs of instructors who are late adopters of educational innovations can be addressed with use of the technology. A comment from a participating instructor exemplifies the value of participation, "This project has been interesting, challenging and rewarding. This opportunity to be a part of XAIDA is most appreciated by me as I have completely changed my attitude and skills toward using computers in the classroom. It is possible for a novice to be successful using this program."

Critical to successfully incorporating technology in instruction is transforming "new projects" into "new ways of thinking." Continued increase in the use of instructional technology at community colleges requires additional planning on the part of those involved in the early projects. Faculty, technical staff, and students at the institutions need to be included in planning the movement toward computerized instruction. As well, organizations that hire college graduates should be included in the planning. A potential exists to form partnerships with industry for courseware development and distribution. Interactive multimedia courseware developed by community college instructors for classroom training would likely be a valuable asset to existing training programs in industry.

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GRADUATE & INSERVICE

On-line Professional Development in the Design of Curriculum-based Telecomputing Projects: Challenges and Successes

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Abstract: In the fall of 1997, the author was hired by a School District in Iowa, as an on-line facilitator to assist a group of ten teachers who were developing curriculum-based telecomputing projects. The administration had great expectations for the use of the Internet, as a curriculum tool. The author chronicle s the challenges and successes she experienced while providing on-line professional development to an eager group of Internet neophytes. The paper includes descriptions of the projects, links to web sites developed by students, teachers and the author, and snippets of e-mail correspondence between the teachers and author. Finally, the author shares her perspective on how such a rigorous endeavor might be better managed. Experience is ultimately the best teacher.

Project History

In the spring of 1997, I was recommended to the College Community School District (CCS) in Cedar Rapids, Iowa, by Dr. Judith Harris, Director of the Electronic Emissary at the University of Texas at Austin, to serve as an on-line facilitator who would assist a group of ten teachers in the development of curriculum-based telecomputing projects. The forward-looking school district had great expectations for the use of technology, and especially the Internet, as a curriculum tool.

Because of my background, both as a 20-year veteran of K-12 classrooms and as an on-line facilitator for teachers and students working with subject matter experts in telementoring projects, I felt confident about the level of expertise that I could bring to the task-at-hand. I had also taught a computing tools course for pre-service teachers for three years while beginning work on a Ph.D. at the University of Texas. I was charged, and ready to undertake this challenge of assisting teachers who were eager to engage the power of the Internet as a curriculum tool for their students.

In April of 1997 several interested teachers submitted applications to the Assistant Superintendent, Al Rowe. The ten teachers, who taught grades three through high school, were selected based upon their previous experience in the use of the Internet and electronic mail (e-mail), and their perceived commitment to the use of telecommunications as a tool to supplement an existing curriculum. In other words, projects would be developed according to the existing curricular needs, and not as simply an opportunity to use technology for the sake of technology. The original goal was that the projects would be developed during the fall of 1997 and completed by the winter break.

In August and prior to the beginning of the school year, Dr. Harris and I spent two days in Iowa conducting a face-to-face preliminary planning session with the teachers. Dr. Harris presented various types of activity structures (Harris, 1997) upon which the teachers could develop their telecomputing projects. I clarified the role that I would fulfill: an on-line support presence that would extend their professional development experiences beyond the limits of a two-day workshop. For a four-month period I would be available by e-mail for direct questions, and I would also provide any unsolicited information that I believed might contribute to the success of their projects.

The objective of the planning session was the creation of student projects which used the Internet both for research and for a telecollaborative sharing of ideas with other classrooms and subject matter experts around the country or world: an objective both wonderful and daunting, to say the least. However, at that point in our planning we all had great expectations.

The teachers worked in teams and individually, and, by the end of the second day, each teacher had a concrete plan for implementation based upon existing curriculum and student needs. In addition, our group familiarized itself with the upgrades to the computer network that had taken place during the summer

break. However, when we said good-bye, I personally felt that I needed another week to completely communicate my function as an on-line facilitator. In retrospect, the two-day meeting was definitely too short a period for the type of planning required for implementation. The teachers seemed to need more time to completely absorb both the complexity of the project development and also the challenges of the computer upgrades.

Project Implementation

Upon my return to Austin, Texas, I began the development of a web-site where the teachers could share their project ideas with each other (http://www.tapr.org/~amill/ccs.html). I believed that such a concrete visualization would be a motivation for everyone. I also began to send a series of e-mail messages to each teacher, as well as a message of encouragement to the group as a whole. In one of the earlier messages I naively stated, "I really hope that the beginning of the school year is off to a super start for you. I know how difficult these first days are and please let me know if any of the telecomputing work is overwhelming to you. I'll do what I can to simplify your lives in any way." (Amill, 1997)

Quite soon I noticed that the teachers' comments were few. At first I found myself wondering about what problems they might be encountering with the projects. Then, I recalled my own experiences as a classroom teacher at the beginning of the school year: new young faces, new procedures, administrative paperwork, and all the elements that make September a very stressful time for everyone. Moreover, to this stew had been added the additional turmoil of embarking upon a new perspective of teaching with technology. In addition, the teachers had to hook the students.

To compound these expected problems, the computer upgrades had caused new problems with the sending of e-mail from the classrooms. New security measures to protect children from unknown dangers on the Internet also impeded the research efforts of the high school students. In addition, three of the teachers had no Internet connectivity from their homes. Together with the CCS administration we struggled to overcome every problem, and we succeeded by the end of the first month.

However, the teacher frustration level due to technical problems had dampened motivation both for the teachers and their students who were eager to really get started. In the spring of 1998, one teacher anonymously commented that the learning of too many technical skills along with managing the project had been overwhelming. The teacher said, "I wouldn't do it again until I get better at running all of the programs, and until the technology is where it needs to be to facilitate the operation."

The level of technical problems had reached such a point that in mid-October I encouraged Dr. Harris to take my place at a mid-semester follow-up in Iowa. I believed that she would might better gauge the situation from a different perspective. As a result of her visit, the teachers were able to express face-to-face with her and with their supportive administrators exactly the technical challenges that they had encountered.

While these problems were being surmounted, I attempted to encourage the teachers to involve their students as much as possible in the planning. Four teachers had decided to work together as pairs in order to develop their project. One pair in particular was successful in involving their students while waiting for technical delays. In a message to them in October I stated, "have [the] students started ANY study of explorers yet? From their textbook for example? They could supply the names and some brief info of the explorers they are interested in learning more about. They could list their questions about the explorers. Perhaps also include a map of the areas where the explorers journeyed."

These two teachers guided their students through a very successful project that included student writings and art work. The primary focus was a study of early European explorers in America. The students also corresponded with a university professor who is a subject matter expert in the colonization of America. He impersonated historical figures and responded to the students' questions in persona. The Explorers project may be seen at http://www.tapr.org/~amill/explorers/expindex.html

A great challenge for me was the search for other classrooms, teachers, and subject matter experts who would collaborate via e-mail with the project teachers and their students. Initially I encouraged the teachers to post their own calls for participation at locations suggested by Dr. Harris. However, due to the demanding schedules of the teachers, I took it upon myself to post the announcements. We received several queries and interested responses, but very few actually came to fruition.

One teacher in California initially appeared very receptive to an on-line collaboration with our high school social studies teacher whose students were preparing research reports on various controversial social groups. The CCS teacher envisioned a type of peer review and critique of her students' papers. Several e-mails which focused on the logistics of exchanging files and pairing students were exchanged between the two teachers. However, within two weeks the California teacher decided for reasons known only to her, to postpone her involvement. She cited lack of time and reluctance on her part to engage in anything that might be seen as controversial. The CCS teacher, although disappointed, acknowledged that perhaps in the future the two might collaborate on another type of project.

Reflections

Between August 13 and December 10, 1997, I exchanged a total of 398 messages with the CCS teachers. I also authored, based upon teacher and student design, four web sites, in addition to the primary site that linked to the original project descriptions submitted by each teacher. Yet, in spite of the hours of work and the knowledge that I had tried my best, I felt disappointed that the projects had not ended as successfully as we had envisioned them during our first two-day meeting in August.

Recently, while preparing this paper I received feedback from a few of the teachers in Cedar Rapids, Iowa. Two teachers indicated that, because of our collaboration last fall, they had developed new web sites with their students. One stated that she had taken a course on web authoring and now felt more confident her skills.

Conclusions

Experience is undeniably the best teacher for me. Were I to undertake such a project again from a distance, I would be aware of the level of commitment in time and energy. However, most importantly, I would first appreciate the fact that while an on-line facilitator works in the privileged environment of technology and the Internet, a classroom teacher must work in a realm where students and a physical setting are dominant.

Thus, the support of a person close at hand seems desirable. Teachers should have access to a local facilitator who may enter their classrooms and have a first-hand look at what physical obstacles must be circumvented in order for the technology to serve its function.

Moreover, both administrators and teachers should be constantly aware that technology depends upon mechanisms that break down or require support. Hardware and software can become dated and cease to function at the level one would desire. Things just fall apart, and one should plan for that eventuality.

Finally, persistence is the key to success. All of us learn from our mistakes and the mistakes of others. My hope is that my experiences, and the experiences of the talented group of teachers with whom I was privileged to work, will be a resource for those interested in on-line professional development.

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Designing a Graduate Educational Technology Course For a New Kind of Learning: Distributive Constructionism in Practice

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Abstract: This paper examines how distributed constructionism was used in designing a graduate course in Contexts of Educational Technology, how that course design was implemented, and how both the instructor and the students in the pilot class reported the benefits and drawbacks of using this model of learning as a course framework. Finding from the study that are presented in the paper includes data gathered from excerpts of student and instructor evaluations of the course, transcripts from on-line communications between students during the course, and information about the course derived from student interviews. Conclusions and recommendations for using a model of distributive constructionism will also be presented.

Introduction

At the Center for Excellence in Education at Northern Arizona University a new graduate degree program in Educational Technology is now being created. Instead of following the usual curriculum development process in which content and teaching methodology are the central issues in course design, this program is taking a very different approach. For this program the focus is learning and how new courses can support the on-going learning of students enrolled in educational technology courses. Using a model of distributed constructionism as a model, course designers first focused on what were the essential components of a learning framework that would help students become successful learners. Educational technology is a field in which knowledge, content, and skills change very rapidly. Students in these courses need more than a presentation of content to become experts in this field. Applications of educational technology are too broad and too far-reaching to rely on traditional models of instruction.

Distributed constructionism is based on the understanding that it is through the process of collaboratively constructing shared understandings of content and by creating meaningful artifacts that learners facilitate the kinds of conceptual change that open new doors to learning (Shaw, 1996). Grounded in the work of Vygotsky (1967) and other cognitive psychologists, constructionism, and particularly distributed constructionism, advocates the creation learning communities in order to facilitate the social construction of new knowledge and skills . The creation of meaningful artifacts moves the focus away from the simple exchange of information between those in a learning community towards a more meaningful and shared creation of knowledge. In directing particular attention to both the social and personal constructions of the active learner, distributed constructionism emphasizes that learning involves creative action within both the learner and the learning community (Resnick, 1996, Shaw, 1996).

The first course designed for this new educational technology program is one titled Contexts of Educational Technology. This an elective graduate level course that explores the historical, social, and cultural

contexts for the uses of technology in education. In this course students examine the broad contexts for using technology in education, and also have an opportunity to examine the learning environment in which they are immersed in during this course. This will provide students with a personal context for understanding how learning and technology use develop within instructional environments as well as a community within which they may interact.

The pilot semester for Context of Technology was Spring Semester 1998. Because the Educational Technology degree was not in place yet, students enrolled in the course that semester represented a diverse range of educational backgrounds as well as a wide range of familiarity with technology. Of the eight students enrolled, only two had any extensive experience with technology. The majority of the class had used computer technology to write papers for their studies, and one had virtually no experience with technology in any form. Degree programs represented in the course ranged from anthropology to English to curriculum and instruction. Several students were completing doctoral programs while others were at the master's level.

The course was held once a week for a three hour evening session. Each session was usually segmented so that students and the instructor met as a seminar for part of the evening and broke into project work for the remainder of the session. During the project portion of the class, students could opt to work with other students or work independently on their own work in progress. Every student was equipped with a laptop computer that not only served as their link to project design, but also allowed them to keep in touch with other students and the instructor at any time. The software provided by the instructor also gave students avenues to connect students with other sources and agencies of expertise that would help support individual projects. Outside of class time students could use this same technology to reach the instructor and other students for help or advice. As a constructionist model of learning advocates, the means for communication between students, and between students and instructor were readily available for collaboration about course content and individual projects within and outside class time.

The instructor and the students evaluated the course twice during the semester. At mid-term students were asked to write a report that included evaluation of five aspects of the course: the readings, interactions with others, individual projects, the instructor, and oneself. At this point in the course, the instructor wrote his own evaluation of the students, their progress with projects, and their understanding of constructionism. At the end of the course both students and instructor repeated these tasks with the addition of a personal reflection about the structure and meaningfulness or usefulness of the course to the students. In addition, during the second half of the semester the instructor and the students in the class were individually interviewed. Conducted by an outside researcher, the interviews focused on the theory, practices, and components of this course. It was felt that after the halfway point in the semester, with individual projects well underway and with a solid basis of shared conversations about course readings behind them, students and the instructor had the necessary frameworks in place to help them discuss constructionism in action.

After the semester ended, all evaluation, internet, and interview data were compiled for analysis. It was hoped that data would shed some light on the usefulness of a constructionist model of learning as the basis for further educational technology course development.

Findings From the Data

From the analysis of the data, it is clear that a course designed with a model of distributed constructionism at the core has powerful implications for both students and instructors. Though students enrolled in this pilot semester of Contexts of Educational Technology represented such diversity in levels of education and content backgrounds most agreed that a model of distributed constructionism placed them in a new role as learners. In interviews with students the words "empowerment" and "independence" kept emerging. Once students understood that they were truly in control of their own learning, there was no stopping them. Student interviews further emphasized that active, not passive, learning was a key (and welcome) component of this course, and while they may have had to make adjustments in their role as a student, it was well worth the effort.

Another aspect of the course that students were overwhelmingly positive about were the projects that were at the center of each individual's learning. In both evaluation and interview data students reported that the ability to make decisions, find resources and to create something new with them was not only a confidence builder but also a link to new avenues of learning. For all the students in the course, the project linked students to resources way beyond the scope of the classroom, or even the campus. One student set up a web link as part of her project that connected people from Africa and Asia by research interest. Another student found his best resource for help in carrying out his project lived outside the United States. The bonds that students formed with these outside resources are one's that all students felt would stay with them through other projects as well. The communication links outside the normal instructor-student-library avenues were powerful tools in establishing a community of learners across the world.

Within the classroom as well, projects connected students in ways that they did not expect. Most students reported that while they didn't feel that they had the expertise in content knowledge or even skill with technology that others in the course had, the interactions of class participants supplied a support system that students felt was necessary to be successful working on their own. The ability to talk a problem through or share progress reports with other students made a real difference in the way students felt about their individual projects. The support system was a common bond that allowed even those people working on very diverse projects to still communicate in a collaborative manner. All students cited the interactions with other students in the class as a necessary component for success in the course.

In analyzing the components of the Contexts of Educational Technology course , it is clear that both students and instructor agreed that taking part in this course pilot taught them as much about learning as it did about educational technology. All agreed that this innovative approach to course design had real implications for learning in future courses. The data from this study point to the following points as key to the successful design of new courses:

- The course framework must create an environment for active learning.
- Quality learning hinges on an ability to be a "self-learner" - the students must take responsibility to be the active learner that a distributed constructionist theory of learning advocates.
- Projects are powerful learning tools.

Participants in the pilot of Contexts of Educational Technology felt that the experience was valuable and that distributive constructionism can be used as a framework for learning in educational technology. With a focus on the learner and not the instructional techniques, constructionism offers a means to develop courses that allow students to grow in ways that traditionally designed courses cannot. This may be a means for the field of educational technology to take advantage of it's ever-changing nature in a way that supports the kinds of learning necessary to advance the field.

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Components of a Viable Technology Model: Designed for the Classroom Teacher

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Abstract: This paper addresses adaptable processes for the regular classroom teacher to integrate technology and the uses of a computer in the classroom setting, involving all students. The ideas are based on a yearlong staff development project and study, which focused on the uses of a computer in the elementary classroom. The study included subjects with various levels of computer literacy; however, due to the majority of participating subjects, the staff development process focused on the classroom teacher with a minimum amount of knowledge in the area of technology. Data were collected in the form of observations, discussions, email correspondence, and surveys.

Introduction

Research has indicated the need for teacher training programs. The field of technology continues to grow in leaps and bounds at an alarming worldwide rate (Daugherty &Boser 1993). "At the heart of a good technology education program is a teacher who displays enthusiasm for the content, the students, and the school. Unfortunately, the supply of energetic, creative, and people-oriented teachers is declining" (Seymour 1993, p. 15). In addition, due to the lack of emphasis and interactions with the computer, many teachers display low levels of training in the technological field (Okinaka 1992). Other research (Becker 1992) reported that teachers with more training with the many uses of the computer were more apt to integrate the curriculum across all areas of study through the use of the computer as a classroom tool. In addition, in this same study, teachers expressed a genuine desire to learn more about technology and requested school systems to provide support and training to the faculty. The planning, organization, and purpose of this program were based on these findings, which applied directly to the eleven classroom teachers, who participated in this study.

Purpose of the Study

Over the course of one year, eleven elementary and middle school classroom teachers participated in a technology staff development project. These teachers were loaned individual laptop computers to use in their school and home environments. Individuals were expected to become familiar with the basic uses and operations of a laptop computer. Once participants felt comfortable in this area, advances were made to enhance and encourage technology in the classroom setting. Ultimately, the goal and purpose was for the teachers to achieve more confidence and sophistication in the various uses of the computer and integrate this new knowledge into the classroom setting. Throughout the project, emphasis was placed on the technology integration possibilities for the classroom, defining technology as a tool that may vary from school to school and teacher to teacher (Dockterman 1998).

Components of Technology Model

Various instructional uses of the computer were incorporated into the staff development program. General topics and uses ranged from record keeping through data banks and spread sheets, use of drill and

practice, interactive simulations for problem solving skills, word processing and writing skills, to the development of higher cognitive thinking skills (Parkay 1995).

Due to the beginning levels of teachers involved in this study, an extensive amount of time and attention centered on teacher attitudes. Rather than viewing the computer as an intimidating addition and obstacle to the classroom curriculum, discussions reflected the concerns, fears and, anxieties of the participants. As a follow-up to these discussions, simple assignments were given, as each subject was given an email address to encourage questioning and communication between colleagues and directors of the program. Early assignments included bookmarking favorite newspapers and journals. Each participant was also assigned to become familiar with the use of email by choosing someone to correspond with throughout the program.

These early assignments encouraged teachers to use the computer on a daily basis, which created continuity, familiarity, drill, and practice. Once these concepts were established, time saving activities were introduced such as the use of record keeping and grade books.

The next stage introduced software and its many uses in the classroom. Emphasis was placed on integrative curriculum and connections to state competencies, along with appropriate and good decision making processes in purchases software. Software in all subjects and on all student levels was introduced for the participants to view and compare. At this point, discussions evolved from the creative ideas and brainstorming activities that enhanced integration of current teaching units and lessons to the software programs.

Ending on the discussions of teaching units and lessons provided a smooth transition into the next stage of the model. This component provided lots of individual freedom and discovery to explore the Internet, particularly educational topics, lessons, units, and various groups. Internet addresses were introduced and a certain number were assigned to each participant, as oral reports were later given to the group.

The final stages of the staff development was based on the concern and need for teacher awareness and classroom and school policies for the prevention of student misuse of the computer. Teacher monitoring, strategies, and teaching methods were addressed during these discussions.

Methodology

Data Collection

Data was collected from observations, discussions, email correspondence, and surveys. The observations, discussions, and email correspondence were a continuous process throughout the project. Surveys consisted of questions to collect data on prior computer experience, opinions, and training. Later data was collected to assess the experience and the continuing needs of the teachers. It should be noted that the data reflected responses to specific computer and staff development times. The individual teacher experiences varied between subjects, levels, age groups, teaching methods, and outcomes, possibly creating different responses and inconsistency during the data collecting.

The first set of data was analyzed based on outstanding themes that were brought forth on a consistent basis, as collected by the project directors. These were determined through the use of the observations, discussions, and correspondence.

The second set of data was analyzed based on survey questioning and responses using a rating scale to gather the data.

Results

Lack of Prior Familiarity

The participants' response to prior computer knowledge and training indicated that 9% felt very familiar with the computer, 18% felt somewhat familiar with the computer, and 73% felt not at all familiar with the computer. These results were also strongly indicated by the participants through early observations, discussions, and the initial response to the email assignment. Participants demonstrated a fear of participating in the staff development, even though they were excited about the laptop itself.

Negative Initial Attitudes

Teachers demonstrated in early staff development meetings, negative attitudes toward the use of the computer in the classroom setting, through their responses and reluctance to try simple assignments. Once the individual initiated attempts to try the simple assignments with success, these negative attitudes began to change into confident and positive attitudes. Drill and repetitive practice proved to be effective in building confidence that affected negative attitudes. The lack of confidence mixed with limited negativity, continued in a pattern throughout the project whenever a new concept was introduced. However, once the teacher felt somewhat comfortable with the new concept, the negativity disappeared until another unknown concept was initiated as a challenge.

Increase in Communication and Creativity

As the project progressed, individual participants brought their own personal topics of interest and motivating experiences to the sessions, as they began to use the computer on their own. These topics and discussions created communication among the group regarding useful sites, Internet addresses, and applicable lesson plans. All participants became more involved with questions and interest.

Final Responses

In the final stages of the staff development project, 45% of the participants felt very comfortable using email as a means for communicating with others, and 55% felt somewhat comfortable using email. Responses to the use of the computer in the classroom indicated that 91% found the use of Internet lesson plans extremely helpful, 91% felt the various software was helpful, followed by 73% indicating that the use of the Internet in general was extremely helpful for class projects and papers.

The survey also consisted of a section on current and future teacher concerns for technology in schools. Results indicated that the lack of funding for computers and technology was the number one concern, followed by the many teachers that tend to feel uncomfortable using the computer in the classroom. The third concern resulted in a tie between the lack of continuing staff development and the lack of building space to house adequate computer labs. The final response indicated concern for the lack of knowledge and enforcement of technological legal policies on the school level.

Conclusions

The results of this particular study reflect similar findings found in other studies regarding teacher confidence and positive attitudes as they are linked to increased technology training and experience (Koontz 1992; Stuhlmann 1998). Results support these findings, as the teachers indicated gaining computer knowledge to enhance familiarity and use in the classroom setting.

In addition, teachers that lack prior knowledge of the computer, find that the use of software programs and readymade lesson and unit plans prove to be the most helpful and the most comfortable methods of introducing the use of a computer in the classroom. The next most helpful method is the integrating of Internet sites to the current curriculum.

Last, the major technological concerns of classroom teachers include appropriate funding and lack of use of technology and computers due to lack of confidence and training. Appropriate building space and legal issues are also topics of concern.

These findings indicate a real need for applicable technology staff development opportunities for classroom teachers. The opportunities need to reflect the level of computer and technology knowledge of the teacher, in order to create positive attitudes and teacher confidence in using the computer. Another suggestion, based on this study, reflects the areas that teachers feel most comfortable with initially, as the computer is introduced in the classroom setting. Also, the need exists for additional funding for computers,

teacher training, and adequate building space to provide teachers and students with appropriate learning technological environments.

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Diffusion, Technology Planning, Professional Development, for In-Service K-12 School Teachers

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Abstract: Diffusion and adoption of educational technology into schools around the country remains a critical issue. If technology is to be for instruction, in-service training and curriculum activities must be developed for teachers. This study uses the resources of a collaborative action research model to identify concerns, attitudes, models of training instruction, school culture, and modes of engagement for the technology diffusion process. Researchers integrate their finding with trainers and school districts to provide a participatory and interactive environment, where the research supports the design process and the design process is informed by the research.

" We believe that teachers are the gateway to change and that ultimately they will determine whether technology will significantly influence education." (Sandholtz, Ringstaff, & Dwyer, 1997)"

Introduction

As school districts adopt technology (hardware and software) in greater numbers, they are being asked to develop diffusion plans that will prepare students, administrators, and teachers to use this tool for instruction. This study looks at diffusion of educational technology in several school districts in the capital region of Albany, New York. Educational technology is defined as the planning, selection of hardware/software, curriculum integration, professional development, and assessment concerns that are part of the diffusion process. The central focus of this research is on the in-service initiatives of classroom teachers, their preparation, and involvement in the diffusion process.

Indeed, when we are looking at the national trends of technology diffusion and adoption we continue to see evidence of technology in the educational developmental process. Computer technology is now perceived as a integral part of nationwide educational reform efforts (Ely 1997). In spite of the increased advocacy for the use of educational technology in schools from government, private enterprise and community groups, teachers have been slow to employ computer applications in their classrooms (McFadden & Johnson 1992, Ely 1997). The "School Technology and Readiness (STAR) Report" (1997) reports that professional development investment is minimal. In 1994, almost 50% of teachers participated in technology related training[1] but only 15 % of that group had at least 9 hours of educational technology training[2]. School districts reported that only 6% of the technology budget was spent on professional development for teachers from 1996 - 1997.

In 1996, when teachers were asked about the greatest barriers to integrating the Internet into the classrooms, 50% of the group stated "the lack of time to train"[3]. They also indicated that the teachers who felt comfortable with technology had access to technology at home[4]. This study will discuss the theoretical base for the research, research questions, setting of the studies, participants, methodologies, findings, and results.

Rationale

For the last three years, The Department of Educational Theory and Practice, The Learning Technologies Laboratory (LTL), The Center for English and Student Achievement (CELA),The Evaluation Consortium, and The Center for Urban Youth and Technology (CUYT) all in the School of Education, have been connected by various school districts in the capital region to assist in diffusion and adoption efforts of educational technology.

To develop a cohesive approach to these issues, a group of researchers, training developers, evaluators, and doctoral graduate students convened to identify training methodologies, research in the field, evaluation techniques, and research design strategies around in-service teachers and diffusion of educational technology.

Research Questions

Our research question centered around teachers and professional development issues that impact the use of educational technology preparation in the school classroom. Our primary research question is: How is educational technology being diffused to teachers in these school districts? There are also secondary questions which include: How are teachers involved in technology planning at the district level?
How are teachers involved in integrating technology into the curriculum? What types of professional development do teacher require? Which models of professional development are most effective in providing in-service training for teachers?

Hypothesis

Our hypothesis states, if teachers are provided with extended and continuous support, training, and equipment for home use, then diffusion of educational technology in school districts will be successful. If teachers begin to understand how to use technology, adopt it into their curriculum and classroom environments, and personalize the capabilities of technology, there will be change. Our research design and review of the literature helped to show evidence of how our research could begin to reach these outcomes.

Literature Review

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[1] Education Week, Quality Counts: A report Card on the Condition of Public Education in the 50 states, 1997.
[2] Education Week, Quality Counts: A report Card on the Condition of Public Education in the 50 states, 1997.
[3] Cable in the Classroom, Teacher Survey, 1997.
[4] QED, Internet Usage in Public Schools, 1997.

A brief review of the literature identified several theoretical basis for in-service teacher training, elements of training design, and key models of successful training,

A constructivist model of professional development as described of Copley (1992) outlines an approach to integrating technology into teacher education. The research on the constructivist concept of anchored instruction by the Technology group at Vanderbilt University (1990) has provided a theoretical foundation for research in this area. Owens (1992) analyzed common types of in-service teacher education about technology and organized them into six different categories. Hoffman, (1996) states, that surveys of teachers indicate that the top three ways that teachers learn their new skills is self-study; attending conferences and workshops on their own time; and taking courses at local colleges. In-service training offered by the school district, and schools ; non in-service courses offered by the school district; coaching from other teachers; and on-site instruction by consultants all ranked below self study in order of importance.

Researchers recommend several important identifiers that should be incorporated into a staff development program to achieve success. 1. Training should be hands on and ongoing (Meltzer & Thomas 1992, Shelton & Jones 1996, Hoffman 1996) ; 2. Training should be carefully designed to address the different developmental needs of participants (Shelton & Jones 1996) ; 3. Technology integration should be the main focus of staff development rather than specific application training. (Hoffman 1996, Grabe & Grabe 1996); 4. Technology should be taught in conjunction with an emphasis on learner centered pedagogical strategies, such as constructivism, collaborative learning and problem based learning (Grabe & Grabe 1996, Meltzer & Thomas 1996); No one approach works for all teachers. Training should be provided in a variety of choices: traditional workshops, in classroom collaborations, mentoring, conferences and whole learning residential workshops (Meltzer & Thomas 1996).

Research Design

An action research model developed by Calhoun, (1993) and supported by Contopidis (1998) was selected for this study. Action Research provides a model for enacting local, action-oriented approaches to inquiry, applying small-scale theorizing to specific problems in specific situations (Denzin & Lincoln, 1994). Stringer, (1996) states that Action research speaks to the current crisis of research by envisaging a collaboration approach to investigation that seeks to engage "subjects" as equal and full participants in the research process. Calhoun's model (see Glantz, 1998, p . 9) allows researchers to investigate areas of concern in classrooms and schools: individually, collaboratively, or school-wide. This research will focus on collaborative action research that is taken on by a group or team of individuals that can focus on one classroom or several classrooms. The research team can also conduct district wide investigations (Glantz, 1998). A qualitative multi-case study approach is used to respond to the research questions and the possibility for replication will provide support for the external validity and the reliability (Yin, 1994 and Contopidis, 1998).

One of the challenges of this action research methodology is to get participants involved in the research process and to share ideas and thoughts in an open environment, where notions, concerns, and problems can be discussed. This process has led researchers to look at various patterns or modes of engagement, where the research informs the process and the process informs the research. This process provides a unique opportunity for the researcher and participant to exchange ideas and concepts that will directly impact what each are doing in their respective sites. This allowed us to apply a set of "look, think, & act" routines to envision the action research collaborative model. In the "Look" section, you gather data and describe the situation. In the "think" section, you explore, analyze, interpret, and explain. In the "act" section you plan, implement, and evaluate (Stringer, 1996). Much of our current research is in the "look" and "think" sections of the various school districts that are involved in the research. This aspect of the model and routine will be developed fully in the methodology section.

Methodology

Our methodology used Glantz (1998) Qualitative-Quantitative Continuum to choose a variety of approaches across the continuum. This allowed us to use qualitative and quantitative methods to support our research focus. To address our concerns about triangulation, we used a multidimensional framework of data collection methods to get a more complete understanding of our research question (s). Creswell, (1994), also provides support for the use of mixed-methodology design. To facilitate this approach the research design was divided into sections.

Phase I - Look.

Ten focus groups met for at one hour an were comprised of in-service and pre-service teachers. They were videotaped, asking about literacy, technology, teacher attitudes, and diffusion of technology concerns at the university and schools in the capital region and New York City. We conducted on street candid interviews with the general public asking similar questions, to see if there were similarities and differences in the responses between the two groups.

The research team received approval from 13 teachers in one district to serve as our research team for the pilot. A series of videotaped interviews with administrators and teachers in one school district to test the interview questions and relevancy of the topic has happened. This district set-up an electronic mail presence and threaded discussion area on the World Wide Web for teachers to query each other, the trainers, and for researchers to ask specific questions on-line. A survey instrument on teacher involvement has been sent to the research group and will be modified and updated for a larger population. We have also monitored the evaluation process reports of the training activities to see where the teachers required support or addressed concerns. Data collected on teacher attitude is being coded and analyzed. Electronic journals are being created by teachers that reflect their day to day concerns about the diffusion process.

Phase II - Think

Collection of teacher artifacts (PowerPoint and HyperStudio) of how they might adopt the technology in the classroom is started. Observation of classrooms of research group teachers by random selection has begun. The observational standards tool has started to be used in the observation process and shared with teachers in the various training sites. Data collection, analysis of field notes from observations, review of journals, e-mail, and threaded discussion are part of this phase. Discussion with research team and participants about our observations.

Phase III - Act

Presentation of research findings to participants to get feedback. Discussion of observational tool for the national standards in technology, English, and information literacy. Potential modification of the training process. Development of the multilevel case study from the pilot study research group. Creation of a larger multiple case study group from other districts. Revisit Phase one, Look section to see if similar environments, personal, climate, attitudes, and concerns exist in school districts.

Settings

Our research focused on in-service teachers, ages 27 - 67, who have been in the schools for 2 - 20 years and cover a range of experiences in their subject areas. Some are novice teachers and others are master teachers, who are subject area specialists and use technology in their classroom. The training focus was to prepare them to integrate technology into the classroom. Our researchers are teachers, trainers, and consultants that are involved in multiple aspects of in-service training in this region. In most cases they have all had classroom experience and have a unique understanding of teacher concerns (i. e. anxiety with technology, teacher involvement, technology support, time for training, and the classroom culture). Several focus group sessions were conducted at the University at Albany, while others were held in Vermont and New York City. The research was also initiated in a pilot district, which is going through technology planning, professional development, and integration of technology presently. Another aspect of the research gathered data from teachers (20 school districts) involved in the technology literacy challenge grant an a commercial partner.

Findings

The preliminary findings of this research has been presented to participants and the research team for their review. The findings are centered around the focus group research, teacher attitude surveys, diffusion of technology training, and the observational tool for standards integration.

Focus Groups

The sessions provided use with attitudes, issues, and concerns that teachers had about literacy and electronic literacy. These focus groups allow us to define teacher related concerns about literacy and technology (Bowman & Swan, 1996).

The focus groups participants provided several different opinions and thoughts about what it is to be literate. Reading skills and the ability to comprehend lead the way in most discussions. Because the groups had educators of different grades, all groups talked about levels of being literate and discussed different basic standards skills that were associated with those levels. Some groups referred to educators as the gate keepers of literacy and presented the importance that the electronic and print plays in maintaining notions of what is literate. All groups agreed that there were different forms of electronic literacy which included, media, visual, computer, information, audio, and television. They further suggested that all forms of new media or technology must be included.

To augment and get a closer understanding of teacher concerns about the issues that were raised about electronic literacy and technology in the focus groups, another researcher in the team looked at teacher attitudes toward using technology.

Teacher's Attitudes

We began the research by looking to teacher's anxiety levels and perceived impact of technology integration on students. The surveys administered to technology training participants were self-reported, and thus may be skewed. More than 60% of the participants reported low technology anxiety levels, over 30 % reported medium technology anxiety levels, and less than 10% reported high technology anxiety levels. The majority of the high technology anxiety levels were reported by teachers with over twenty years of teaching experience (approximately 50%).

Participants perceived the use of technology in educational settings as having substantial impact on students cognitive, affective, and psycho-social development. They also felt that the greatest impact of technology would be on students' cognitive ability, especially problem-solving and analytical skills. Students' affective areas, such as motivation and development of individual talents were also perceived by teachers as being impacted by technology. Psycho-social domains, such as dependability, productivity, and self-esteem were perceived as being impacted but to a lesser extent.

To turn the tables, we looked at what we saw emerging with the training models that were being used in the various school districts and programs.

Diffusion of technology training

To date, several models have been employed in the diffusion of teacher technology training. The training is provided by professional training staff, several of which are former teachers. While involved in this training process some participants developed a dissemination plan within their school that promotes technology integration. The most common model of technology diffusion involves the technology training participants returning to their schools and training individual teachers in computer applications as well as effective use of the computer as a tool in the classroom. The turnkey model is also employed. Several teachers have been hired to work part-time as Master Teachers who are viewed as technology and creativity troubleshooters for previous training participants and their school districts.

One of the most important factors to examine are the overall goals of the training program, which can be technology integration, curriculum development, or development of skills. The type of instruction, whether hands-on, lecture, demonstration or modeling is important when evaluating such programs. Holmes and Callendar, researcher/trainers in our team expressed there concerns about training and made these observations.

> " We have witnessed one factor that many programs seem to neglect. As an instructor, you provide the student with the resources and knowledge that will help them use the tools successfully. However as a student, sometimes having the resources and knowledge about how to use the tools are not enough. It is the moment when things go awry that teachers need the most assistance and it is training programs that provide support at that awkward moment of implementation that we advocate".

Our preliminary research has looked at in-service teacher issues of literacy, electronic literacy, and technology. The research has identified concerns that the trainers have as they develop and implement technology training programs for teachers.

While several of the team was exploring, interpreting, and explaining what was happening, another team member started to look at the role of the new national educational standards in information literacy, English, and technology. This researcher was concerned about how would teachers diffuse the standards into the educational technology process in their classrooms?

National Standards

We are exploring the utility of performance-based, non-print literacy standards for assessing the impact of educational technology training programs at three iterative levels at the level of teacher knowledge which looks at what non-print literacies are being incorporated into classroom teaching and learning), and at the level of student performance (which looks at what non-print literacies students have acquired). We have used three sets of national standards to identify what non-print literacies experts believe students should have by the completion of elementary, middle and high school. These are the National Educational Technology Standards, developed by the International Society for Technology in Education, the Information Literacy Standards for Student Learning, developed by the American Association of School Librarians and the Association for Educational Communication and Technology, and the Standards for the English Language Arts, developed by the International Reading Association and the National Council of Teachers of English.

Checklists have been created to assess professional development in the short (teacher knowledge), middle (curricular integration), and/or long (student performance) term for all grade levels and across the curriculum. In particular, because the

checklists address non-print literacies, they can be applied to the assessment of technology integration in any content area. This allows us to compare and contrast differing models of professional development. It also focuses our assessments on the goals for which these models were designed.

Closing

This aspect of the action research model has allowed use to evaluate the importance of our "look, think, and act" routine on a small scale to see its functionality and importance in our work. The research design process has informed us about a variety of theoretical models that inform and support the research about diffusion of educational technology and teacher in-service education. The research has allowed us as researchers to hear the voices of the teachers, school administration, and other concerned stakeholders in this process. Our research has begun to breakdown the barriers that are sometime implied when the term "research" is used in school settings. We have been able to identify models of teacher training that can be shared with technology training designers who are creating training programs and materials for these districts. We are now developing a link between the national standards and the classroom. This checklist provides identifiers of what skills and performance indicators are necessary for teachers learn and utilize in instruction.

The initial research agenda and plan has done much to develop a sense of respect and trust between researchers, administrators, and in-service educators, that can lead to greater collaboration and reflection about educational technology and teachers. Our next steps are to complete the case studies of four classes at the pilot district and then replicate the cases to other districts, looking for similarities and differences that we can share to improve the dialog between teachers, school administration, and researchers. This is also the first stages of using this model on a much larger scale where interaction between school districts and the community is involved.

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Implementing a Computer/Technology Endorsement in a Classroom Technology Master's Program

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Abstract: In the spring of 1998, the Master's program in Classroom Technology at Bowling Green State University was granted conditional approval to grant, as part of the program, the new State of Ohio Department of Education computer/technology endorsement. This paper briefly describes Ohio's change from certification to licensure, the removal of relevant previous certificates(e.g.., computer science), and the licensure/endorsement model. Further, the specifics of the computer/technology endorsement as covered in the Classroom Technology Master's program, are covered, as well as the process of moving from conditional to full approval(which is expected in the winter of 1999). Lastly, the recent OhioSchoolNet (a separate state agency) program of awarding novice, practitioner and scholar technology certificates to teachers is explained in relation to the state computer/technology endorsement.

Introduction

Through early national reports and studies (Gardner, 1983; Martinez & Mead, 1988) as well as a realization that technology is an empowering force in modern society and therefore a necessary component of the schooling experience (Marshall & Bannon; 1988,Naron & Estes, 1986; Gilder, 1993), the importance of technology in schooling has been well established. As a component of this interest in technology and learning, organizations such as the Society for Information Technology and Teacher Education (SITE), and the International Society for Technology in Education (ISTE) began, in the decade of the 90's, to establish formal means for preparing both inservice and preservice teachers to use technology with students. An outgrowth of this interest was, for teachers, a set of national guidelines in computer education developed by the International Society for Technology in Education and adopted by the National Council for Accreditation of Teacher Education(NCATE), (ISTE, 1992; NCATE, 1992; Thomas, 1993). As could be expected, these guidelines have become part of both preservice and inservice programs in teacher education (Brownell &Brownell, 1998; Brownell, Haney & Sternberg, 1997; Handler & Strudler, 1997; Strudler, Handler, & Falba, 1998) and have helped to spur relevant endorsements to teacher's licenses and certificates at the state level (Ohio Department of Education, 1996). This paper presents a brief overview of the implementation of the State of Ohio Department of Education computer/technology endorsement within a Master's program in Classroom Technology at Bowling Green State University.

The Program

The Master of Education program in ClassroomTechnology (described in more detail in Brownell, Haney & Sternberg, 1997)is based upon the ISTE standards (ISTE, 1992; NCATE, 1992). The programcomprises 33 semester hours and is designed for the working professional to take over a 26 month period.Participants take courses over fall and spring semesters, as well as oversummers, in a prescribed sequence. A list of courses in the program,presented in the currently prescribed sequence, follows.

EDCI631 Survey of Computers in Education (3)
EDCI611 The Curriculum (3)
EDCI633 Hypermedia for Educators I (3)
EDCI634 Hypermedia for Educators II (3)
EDCI635 Classroom Technology, Problem Solving, and the Curriculum (3)
EDCI636 Networks for Learning (3)
EDCI632 Classroom Technology Planning in Education (3)
EDFI641 Statistics in Education (3)
EDFI642 Research in Education (3)
EDCI637 Distance Learning and Education (3)
EDCI638 Seminar on Classroom Technology and Learning (3)

Originally, the program was designed so that there were seven required core courses and four suggested courses, as follows.

Required core:

EDCI 631Survey of Computers in Education (3)
EDCI632 Classroom Technology Planning in Education (3)
EDCI633 Hypermedia for Educators I (3)
EDCI611 The Curriculum (3)
EDFI641 Statistics in Education (3)
EDFI642 Research in Education (3)
EDCI638 Seminar on Classroom Technology and Learning (3)

Suggested:

EDCI 634 Hypermedia forEducators II (3)
EDCI635 Classroom Technology, Problem Solving, and the Curriculum (3)
EDCI636 Networks for Learning(3)
EDCI637 Distance Learning andEducation (3)

In this design, students wereallowed to substitute approved electives for up to all four of thesuggested courses. This option will still be available to students in theprogram who elect to not gain the computer/technology endorsement, but willnot be an option, as explained below, for students seekingthe endorsement.

From Certification to Licensure

In 1997, Ohio changed from a state whichoffered the standard elementary, secondary, etc., certification to it'steachers to a state which now offers a teaching license in one of threeareas: early childhood, middle childhood, and adolescence to young adult. It is beyond the scope of this paper to discussthe particulars of this change other than to note two pertinent points.First, in doing so, the Ohio State Department of Education did away withthe previous computer science certification (which required, essentially, a bachelor's degree in computerscience plus relevant education course work, methods experiences, andstudent teaching); and second, a computer/technology endorsement wascreated.

Presently, as far as we have been able todetermine through the state, there are no plans for a computer scienceendorsement to replace the withdrawn computer science certificate. Itshould be noted, however, that the state is currently investigating this (possible) oversight with an eye towards takingcorrective action in the future.

The Computer/Technology Endorsement

The computer/technology endorsement is basedon the ISTE Standards. The endorsement is granted to an applicant whoholds a valid Ohio teacher certificate or license at the grade level forwhich the certificate or license is held.

In the spring of 1998, six course syllabi(complete with course description and objectives) were submitted to thestate to obtain permission to grant the endorsement. Also included was agrid identifying each ISTE Standard and the course or courses that covered the standard. The six courses were(obviously) chosen from among the program offerings because they mostclosely were in alignment with the ISTE Standards as specified by thestate. The six courses are:

EDCI 631Survey of Computers in Education (3)
EDCI633 Hypermedia for Educators I (3)
EDCI634 Hypermedia for Educators II (3)
EDCI635 Classroom Technology, Problem Solving, and the Curriculum (3)
EDCI636 Networks for Learning (3)
EDCI632 Classroom Technology Planning in Education (3)

In late spring, 1998, the program receivedconditional approval to grant the endorsement. Conditional approval meansthe program can grant the endorsement but must also file a rejoinder toaddress several areas where the state desired clarification. In mid-October, 1998, the rejoinder was filed and theresponse from the state (full approval, it is hoped) is expected bymid-December, 1998.

The rejoinder took the form, for each of thesix courses, of a course description (the same as the original coursedescription) coupled to a set of revised objectives for the course.Mostly, what was already being done in the course was explicated for sake of clarity, while in some instances new objectiveswere written which aligned with both the ISTE standard under considerationand the original course description. Additionally, an updated grid of ISTEStandards (as supplied by the state) and the course or courses which covered each given standard, wassupplied to the state. (*Please note:* During the presentation we will supply a relevant,current web address for one of the author's (Blanche O'Bannon's) home pagewhere a link will be available to view, from March 1, 1999, through January1, 2000, the full set of course descriptions/objectives and the full ISTE Standards/Course Implementationgrid.) Table 1, below, offers a sample course descriptionand associated objectives.

> EDCI 636 - Networks for Learning(3) - Intensive investigation of and experiences with tools to access, andresources available on, the Internet. Creation of Web pages. Applicationsacross the curriculum. Investigation of relevant issues regarding privacy, censorship, commercialism and proprietary rights.Prerequisite: EDCI 631 - Survey of Computers in Education.
>
> EDCI 636 - Networks for Learning- Objectives:
>
> 1. Understand the current state of resources on theInternet including the World Wide Web, telnet, gopher, file transferprotocol and how these tools are utilized in K - 12 education, as well asprojections for the growth and evolution of this resource.
> 2. Understand the evolving state of audio and videocommunications over the Internet.
> 3. Investigate and use a wide range of resourcesavailable through the Internet including the World Wide Web.
> 4. Observe, and discuss, the use of networks with students in a relevant K-12 setting.

5. After investigating and evaluating relevant web sitesfor use in K-12 education, develop and practice delivering a series ofcollaborative learning experiences to teach diverse student populations touse web sites in one or more content areas.
6. Produce a product for teacher use in an area ofmanagement or preparation for teaching, that makes use of a number ofnetwork resources.
7. Gain HTML skills, and associated design skills, inorder to develop 1) a personal web page and 2) a public web site related toeducation.
8. Understand, conceptually, the specifics of theprocess of linking web sites.
9. Understand and analyze various positions related tonetworks and the following relevant issues: privacy, equity, censorship,commercialism, proprietary rights, and other legal issues.
10. Become familiar with,demonstrate an understanding of, and practice, various methods for teachingabout and integrating electronic networks into the classroom for diversestudent populations.
11. Become familiar with, and demonstrate anunderstanding of, the current literature on the use of electronic networksin the classroom, regarding best practice.
12. Become familiar with, and demonstrate anunderstanding of, the current literature on the use of electronic networksin the classroom, regarding current research on such use.
13. Demonstrate knowledge of communication/research at adistance, and educational collaboration at a distance, through thecollaborative use of e-mail, listservs, automated search tools.to locatespecific information, and through awareness of Internet-based/web-based courses.
14. Observe demonstrations/uses of broadcast instructionand audio/visual conferencing.
15. Use devices such as scanners and digital cameras indevelopment of a web page.
16. Demonstrate a knowledge of web-based resources tosupport the use of technology with special needs students.
17. Locate and describe current, relevant softwarepackages used to operate computer network systems.
18. Investigate and evaluate web sites and othernetworked resources regarding lifelong learning and distance educationopportunities.
19. Understand and develop school/lab responsible usepolicies and procedures regarding the use of computers/technology,including the use of local and wide area networks, addressing issuesincluding (among others) ethics, equity, privacy, equipment care and maintenance.

Table 1. A Sample CourseDescription and Objectives

Implementation

With the graduation of the first cohort ofstudentsfrom the program in December of 1998, it is expected that thefirst set of endorsements will be granted in the early spring. In thefuture, students in the program may opt for earning the endorsement within the program, in which case all courses in theprogram except EDCI 637 - Distance Learning, will be required. If studentsopt to forego the endorsement, they will be able to substitute up to 12credits of valid electives in place of the 12 credits of "Suggested," courses identified above. There arecurrently, due to a lack of sufficient hardware/software and personnelresources, no plans to offer the endorsement outside of the Master'sprogram.

Interestingly, SchoolNet, a state programwithin Ohio which has been funded by the legislature for over 500 milliondollars and is charged with supplying equipment, wiring and teachertraining regarding technology to Ohio's schools, has begun offering novice, practitioner and scholar technologycertificates to teachers. Historically, since SchoolNet and the StateDepartment of Education are separate units within the state, there appearsto have been little, if any, coordination between the SchoolNet certificateprogram and the Department of Education endorsement incomputers/technology. Although SchoolNet does not have credentiallingauthority, many individuals are currently working to bring some coordinatedeffort to both the excellent work SchoolNet

has been doing and the fineinitiatives coming from the State Department of Education. Such a coordinated effort in the area oftechnology and teacher education would only benefit the teachers andstudents of Ohio.

Conclusion

The foresight of the individuals involved inthe ISTE effort to establish technology and teacher education standards atboth the preservice and inservice levels, and in successfully presentingthose standards to NCATE, has been a boon to those involved in technology and teacher education. The design of theprogram referenced here, as well as the adoption by Ohio of the ISTEStandards regarding the Ohio computer/technology endorsement, have nicelydovetailed to serve the teachers within our service area. By doing so, we make good things possible withtechnology to all the groups we serve including teachers, students, and thepopulation at large.

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Collaborative Technology Development: A Staff Development Model for Integrating Computers into School Curriculum

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Abstract: This paper documents the methodology, research process, process interventions, and the resulting quality indicators of a technology staff development project. This project was designed to assist the administration at an elementary school in San Diego, California, in developing a capacity building model of staff development which would support the effective integration of technology into the curriculum. The aims of the project were to develop basic computer expertise among teachers, while providing them with immediate strategies and resources to assist them in effectively utilizing computers with their students their classroom environments.

Introduction

The classroom environment is changing in every school in the United States. Today, 98% of all schools in the United States have computers (Educational Testing Service [ETS],1997). According to the National Center for Educational Statistics (cited in Vojek, 1997), "65% of all US public schools had access to the Internet as of the fall of 1996". During the same period 14% of all classrooms had Internet access, and by the year 2000, it is predicted, that all public schools in this country will have Internet access. What these statistics suggest is that technology access is on the rise in every American classroom. However, more computers and greater access to the World Wide Web in and of themselves guarantee nothing (Foa, Johnson & Schwab, 1997). Their expanding presence does raise questions however about the ways teachers are being prepared to utilize such technology within their classrooms and curriculum. Additionally, this growing presence of technology demands that schools be prepared in providing technological support and training in the use of such resources to staff and teachers. This paper documents one schools journey in meeting this challenge and as such provides a model of a staff development program assisting teachers in their own technological development and the skills for integrating technology into their elementary classrooms

This project was developed to assist the administration at Caesar Chavez Elementary school in San Diego, California, in developing a program for teachers that supported effective integration of technology into the curriculum. The aims of the project were to develop basic computer expertise among the teachers, while providing them with immediate strategies and resources to enable them to utilize computers with their students in their current curriculum and classroom environments.

According to the report, Computers and Classrooms: The Status of Technology in U.S. Schools (ETS, 1997) the average student to computer ratio is ten students for every one computer. At the time of this project (1997-98 school year) the average student to computer ratio at Chavez Elementary, was twelve students for every one computer. Salpeter (1997) stated, that "interactive technology plays little more than an incidental role in classrooms". The rationalization postulated for this incidental role was high student/computer ratios. Salpeter (1997) further stated that this role is often the "result of teaching approaches and curricula that place relatively little value on technology as a tool". This real concern was at the forefront in the planning and development stages of this project. The principal of Chavez Elementary made it clear at the outset of this project that the teaching staff should not only value the technology they would have access to (2 computers and a color printer in every classroom hooked to a school site server), but have effective instruction and support that would allow teachers to effectively utilize the school based technology as a resource tool within their classroom environment.

This paper documents the year long process of technology staff development at Chavez Elementary School, an inner city school with a student enrollment of 600. The project was funded by the Corporation of Public Broadcasting through the Ernest Boyer Summit Next Step Grant project funds. The first two sections

of this paper document and review the research methodology and scope of the action research process utilized to determine needs and develop relevant training materials and activities. This process was key to the initial and continued support the school staff provided in terms of the spaces created for the development of innovative programs and working relationships. The third section, reviews the sequence of the intervention phases and training models developed. The paper then documents the quality indicators that resulted from this research, including those that led to capacity building among the teaching staff. The final section, provides recommendations for the continued support and development of technology use at Chavez Elementary. It is hoped that this paper will provide a working model for other school sites interested in developing a site-based technology staff development program. A copy of this report and the research tools utilized within this project are available on the project web site at http://edweb.sdsu.edu./plc/cpb/.

Methodology

This project followed a collaborative action research model, which not only accounts for, but values and requires the experiences and perceptions of all participants with the "fundamental aim to improve practice rather than to produce knowledge" (Elliott, 1991) . In this manner the project was designed to include the administrators, teachers, and staff from Chavez Elementary along with the grant administrators from San Diego State University in formulating goals, materials, and activities for technology integration. This was first addressed by creating an on-site Technology Committee, comprised of seven teachers, one representative for each grade level, and the Project Researcher from San Diego State University. The committee met monthly throughout the project year to dialogue about staff and student needs, evaluate software, design and develop technology support materials, and to coordinate and implement on-site training activities. The school staff, with support from the administration, advocated for on-site technology training that addressed the specific needs of the school and community.

Needs assessment instruments, taking the form of surveys and questionnaires were developed and utilized to help guide the process of developing teacher training models, identifying immediate needs and future requirements, and setting goals to ensure quality, comprehensible technology integration. Continual dialogue and reflection was the key to this methodology and contributed to the project's success. To this end the Project Researcher and Technology Committee met with teachers, staff, and administrators regularly to respond to technology concerns and classroom management issues related to the training and integration of computer software and hardware.

Needs assessment data were collected throughout the project via six survey/questionnaire instruments. These instruments were constructed based on the site network server, and computer software and hardware available to teachers at the school site. Teachers and staff were also sent weekly electronic mail (e-mail) messages informing them of curriculum related world wide web (WWW) sites with a request for feedback on their use of these sites. In addition, the Project Researcher gathered informal anecdotal data through classroom observations and conversations with administrators, teachers, and staff to determine effectiveness of the process.

The research process was documented from the beginning of this project via a project web page created utilizing Claris Home page. This creation and maintenance of this website was a requirement of the funding organization, the Corporation of Public Broadcasting.

Research Process

Scope

In order to implement not only the new technology, but training and development it was crucial for the Project Researcher, who was not part of the school community, to establish a collaborative role and to gain the support and trust of the school administration. According to DeBevoise (1986), successful collaboration begins with administrative support along with the ability of the collaborator to gain trust by discovering common and unifying interests, while not becoming involved in the internal politics of the outside institution. At Chavez this relationship was established by assisting in the set-up of hardware and networking communications at the beginning of the school year. Since this was a new school the computers arrived in boxes and required much physical set-up. By being available to assist in the hardware

set-up the Project Researcher established respect and a positive rapport by sharing in the responsibilities at the outset. In addition, relationships were developed and maintained with other staff members through individual coaching sessions. Such sessions, lead by the Project Researcher and members of the Technology Committee, were designed to assist classroom teachers in the basic set-up and use of their classroom computers.

The collaboration process also included visits with the Principal and Resource Teacher to review in-service schedules and technological needs, along with two initial in-services for the teaching staff; one detailing the use of their e-mail software and the second on the use of word processing and drawing software as a computer center. These activities (set-up, coaching, in-services) not only provided the staff with an introduction to the role of the Project Researcher, but also allowed them to see the commitment the Project Researcher had to their school and program. The establishment of commitment and trust early in the project was a key to the success. As DeBevoise (1986) points out: "In the end, collaboration depends on people on both sides being willing to make it work. You can have as elaborate a mechanism as you like, but that won't carry things through. It's the people that matter "(p.12).

Needs Assessment

In order to understand the difference in training models, this project was designed to achieve, it is important to review the training the teachers at this school received in computer use prior to the implementation of this project. The Project Researcher was invited to observe and attend the required two day (12 hours) school district computer training classes. In this class the teachers received computer technology instruction in several software programs and multi-media hardware. Notes from the observation of this training can be found in Table 1. What is important to note here is the vast amount of technological information covered compared to the experience most of the teachers had with computers at this point in time. On the initial survey completed by the teaching staff, 70% indicated that their primary use of computers was for completing word processing tasks indicating that most teachers were unfamiliar with the use of the software being covered and the regular use of computers in general.

I) Instruction in the use of the following software:

a) *Claris Works* word processing, database and mail merge functions, the in-service included practice on sending parent letters, setting up a classroom database and using the information from both to utilize the mail merge function.

b) *Quick Mail Pro* (e-mail software) for this software practice included setting addresses, choosing a background for a message, entering passwords, and sending and receiving e-mail.

c) *Netscape Navigator* this instruction focused on browsing the web and setting bookmarks.

II) Teachers received an overview of multi-media equipment and software that they would have access to in their classrooms, included in this presentation were:

a) a demonstration of using cable television in the classroom

b) the utilization of camcorders and small hand held video cameras

c) brief instruction on how video images could be incorporated into classroom projects.

d) an overview of the school cable network and use for classroom broadcasting.

Table 1: Summary of District Computer Training Session

During these two days of training it was observed that of the 23 teachers attending this in-service 75% had little to no experience utilizing computers. The other 25%, in addition to myself, assisted the technology instructor in coaching teachers through the required tasks. The majority of teachers were frustrated and uncomfortable with the vast amount of information and the limited time they had to practice and absorb what they were being presented with. This became a point of reflection for the Project Researcher and Technology Committee, it was determined that while this was valuable training that all teachers needed, future training needed to be more site-specific and focus on one software or hardware application with instruction at a level where teachers would feel comfortable and not overwhelmed.

To address this concern a needs assessment survey was developed to assist in the development of on-site training. The results from items assessing computer experience (Table 2) revealed that while the majority of teachers were comfortable utilizing word processing software (96%) and basic desktop (95%) applications they also indicated a desire for more specific training in curriculum related software such as *Hyperstudio*

(68%) and *Storybook Weaver* (60%). Programs that were not part of the district training and programs that are more project oriented and student centered.

Item #13: Identify the software and/or hardware applications you are comfortable using.	**Percent of Teachers**
Basic Mac	96%
Claris Works: Word	95%
NetScape - Internet	70%
Claris Works: Spreadsheet	22%
Claris Works: Database	18%
Multi-Media	12%
Item #14: Identify three software and/or hardware applications you would like to receive further training in.	
HyperStudio	68%
StoryBook Weaver	60%
Basic Mac Instruction	50%
Claris Works: Database	45%
Claris Works: Spreadsheet	45%
NetScape - Internet	32%
Multi-Media	23%
Encarta '97 - Encyclopedia	22%
QuickMail Pro	14%
Claris Works: Word & Drawing	12%

Table 2: Results of Items 13 & 14 of Pre-Assessment

Process Interventions

Based on these survey results and continual contact and dialogue with the Chavez administrators and teaching staff, a staff development program consisting of four phases was developed and implemented by the Project Researcher and Technology Committee, these phases consisted of:

Phase 1: School wide In-Service Training Sessions: Trainers: Technology Committee and the Project Researcher; Focus: Using Quick-Mail Pro* Using ClarisWorks Drawing in Computer Centers; Individual Coaching on Classroom Computer Use as requested by teachers.
Phase 2: Weekly e-mail correspondence: Trainer: Project Researcher; Focus: Working with E-Mail and Introducing use of the Internet through curriculum websites.
Phase 3: Technology Training Trees: Trainers: Technology Committee lead other staff members with technology expertise, who in turn trained teachers; Focus: Use of Quick Mail, Mac Basics, Storybook Weaver, and Netscape.
Phase 4: On-Site Workshop Series: Trainers: Technology Committee & Project Researcher;
Focus: HyperStudio, Story Book Weaver Software, Multi-Media Equipment including the Scanner and Projection Unit, Internet and Classroom TV usage, Classroom Management and Curriculum based software, Utilizing the School Network and CD ROM Tower.

Quality Indicators

In order to evaluate the effectiveness of these programs teachers completed evaluation summaries after completing each of the two workshop series. Upon completion of the project the staff completed a post assessment survey to evaluate the program. The results of the Evaluation Summaries, Table 3, indicated that after the first workshop 89% of the teachers believed that the workshops provided them with new methods and strategies that they could use in the classroom, after the second workshop 94% of the teachers agreed with this statement. In addition after the first workshop 89% of the teachers believed that the on-site workshops were a productive use of staff-development hours, and after the second workshop series 100% of the teachers agreed with this item. Overall, the workshop series was a great success partly due to the fact that the sessions were lead by teachers on-site and that participants were able to choose which areas they wanted

training in. The comments received (Table 4) from the teachers revealed that most felt that the workshops were beneficial because of the "hands-on" opportunities and the ideas they were able to put to use "right away".

Workshop Series Evaluation Questions

Q1. These workshops provided me with knowledge of new methods and strategies I can use in my classroom.

Q2. The material presented was relevant to my grade level and subject area.

Q3. I found these on-site workshops to be a productive use of staff development hours.

Q4. I plan to use the computer software demonstrated in the next month.

Response Data: March 13, 1998 Workshop I

	Q #1	Q #2	Q #3	Q #4
Strongly Agree	17	16	15	12
Agree	0	1	2	6
Undecided	2	1	2	1
Disagree	0	0	0	0
Strongly Disagree	0	1	0	0
Percent SA/A=	89%	89%	89%	95%

Total Evaluation Responses = 19*

Response Data: July 17, 1998 Workshop II

	Q #1	Q #2	Q #3	Q #4
Strongly Agree	13	13	14	14
Agree	4	3	4	3
Undecided	1	2	0	1
Disagree	0	0	0	0
Strongly Disagree	0	1	0	0
Percent SA/A=	94%	89%	100%	94%

Total Evaluation Responses = 18* 6 teachers did not respond since they were providing instruction.

Table 3: Workshop Series Evaluation Data

The comparison of the pre and post assessment data and classroom observations, revealed trends of increased knowledge and use of computers in the classroom by both teachers and students, more classrooms utilizing word processing software to complete projects and an increase in the use of HyperStudio, graphics, encyclopedia and CD ROM software within the K-6 curriculum.

In addition, during Phase 4 the Technology Committee wrote and received funding for a district grant project that will support professional development and the integration of new technologies into local education reform efforts. This grant will be funded until the year 2001 by the Patterns Project which is part of Triton, a multi-partner educational collaborative that integrates technology with the standards-based education reform efforts of the San Diego City Schools to create new learning opportunities for students and teachers. It is towards this end that this project assisted in capacity building above and beyond expectations.

The teachers on the Technology Committee began the school year with a vision of assisting teachers in utilizing the computers in their classrooms and by the end of the project were coaching their peers, leading staff development workshops, and finally being the first school in the district to receive a set of *Oracle Computers* for grade 3-6 teachers based on the amount of technology expertise and classroom technology integration at the school site.

I came expecting to...	I got...
.. increase my knowledge of software.	..a great hands-on demonstration.
..learn new programs to use in my classroom.	..new ideas on implementing programs.
..be less afraid to incorporate computers in the classroom.	..valuable web sites to use.
	..lots of wonderful ideas that I will use right away.
.. learn how to use the Internet for my grade level.	..great ideas for using the Internet in my classroom
.. learn about general applications for the computer.	..quality instruction!

I value...	I want next...
..Todd's detailed in-depth explanations. ..the technology we have here at Chavez. ..my colleagues expertise and assistance. .. the time and patience of the tech. instructors. .. teachers taking time to develop workshops.	..how to set-up my launcher with lots of programs for my students. ..more practice with spreadsheets and databases. ..a personal visit during class and doing an activity with my class.

Table 4: Teacher Comments on Workshop II

Recommendations

Upon completion of the project it was noted that the Technology Training Trees, although not as successful as anticipated, would be implemented again next year with more structure and support. It should be noted that this was a brand new school and in addition to setting up and utilizing technology teachers and staff were also involved in designing and implementing school wide procedures, establishing school policy and teaching at a new school site with a variety of technical and physical interruptions. Thus, establishing the role of technology was part of a multi-faceted school year with many goals and challenges.

The workshop series will continue into the next school year; however in order to allow for more teachers to attend workshops the series will be held more often and with less sessions. The intent is to provide staff and presenters with the opportunity to attend the range of sessions offered over the schools year. The plan is to offer the six workshops from Workshop Series II in groups of three sessions over four staff development days.

Finally, the school site will have, starting with the 1998-99 school year, a computer lab and a full time technology teacher. This project proved successful in laying the groundwork for site-based staff development and has become a model for the further development of technology at Chavez Elementary.

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Permanent High Capacity Digital Portfolio System

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Abstract: New innovations in education today include Howard Gardner's Multiple Intelligences, outcome based assessment, portfolio assessment, and technology in education. All of these speak of child centered learning where children, teachers, and parents are partners in the process of learning. The challenge for today's schools is to incorporate these into curriculum and instruction on a daily basis. The appropriate use of technology is the answer. Although many schools today are equipped with the technological hardware, the use of these in the development and managing of classroom systems is limited or nonexistent. One such area for technological assistance is portfolio assessment. Participants will view examples of computerized portfolio system designed by the presenter and her students. Time management and organizational strategies used across the curriculum will be shared. Educators from all grade levels will be introduced to using HyperStudio and other software programs in the development of multimedia portfolios.

A Model for In-Service Teacher Training on Internet

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Abstract: According to the literature on effective in-service teacher training and the characteristics of the Internet technology, this paper proposes a model and a supporting system for in-service teacher training on the Internet. The model is constituted by five components. They are training curriculum, learning assistance, community connection, assessment and evaluation, as well as credits and credentials. These components are implemented and supported by nine subsystems, including training curriculum, curriculum management, learning assistance, community connection, assessment and evaluation, credential granting, user management, tracing and analyzing, in addition to login interface.

Introduction

The effectiveness of teachers is a determinant of educational quality. In addition to pre-service education, in-service training is also important to enhance the effectiveness of teachers. Particularly because modern society and information changes rapidly, pre-service education is no longer enough for teachers to keep abreast with current trends and maintain high quality of instruction.

In-service teacher training usually includes the forms of long-term study for advanced degrees and short-term workshops held by teacher training institutes. Teachers have to be present in a particular place and time for the training. The rapid development of network technology can reduce the restrictions and extend the opportunity for teaching and learning. Because this technology allows learning to occur anywhere and anytime.

Network technology has been used much for student learning. Its use could enhance interaction [Webb 1997], induce fair learning, facilitate learners' cognition construction [Harasim 1990], and is as effective as the traditional classroom [Hiltz 1990, 1994]. Network involvement in teacher training is also feasible and is getting more and more attention. Scholars recommended that teacher training use Internet technology and not be limited to traditional formats [Marx, Blumenfeld, & Krajcik 1998]. In fact, many programs and projects (in many countries, such as Canada, United States, England, Malaysia, Dane and Netherlands) have brought Internet (and multimedia) technology into in-service teacher training [Collis 1994]. However, most applications are still experimental, and related literature is distinctly lacking.

A Model for In-service Teacher Training on Internet

The development of Internet technology provides a new approach for in-service teacher training. Through the Internet, in-service teacher training can be easily extended. Distance and time are reduced as obstacles or excuses for attending training. However, inclusion of this technology into teacher training is not a panacea. Only under thorough, careful consideration and appropriate design will teacher training over the Internet be productive.

Literature investigation [Glickman 1985; Korinkek, Schmid & McAdams 1985; Olivero 1982; Olson 1981; Wade 1984] determined that an effective teacher training must fulfill certain requirements. These requirements are summarized as follows: (a) it should satisfy the needs of teachers; (b) it should encourage teachers' participation in the design of training programs; (c) it should have the support of administrators; (d) the

goal of the training curriculum should be concrete and clear; (e) the training methods should be flexible and varied; (f) school based training is better; (g) it should take into account the individual differences in teachers; (h) the training time should be convenient, continuous and sufficient; (i) it should provide the opportunity for both independent and individual study; (j) teaching practice and constructive feedback should be emphasized; (k) it should allow sharing and assistance among teachers; (l) assessment is necessary and critical;and (m) encouragement should be provided for teachers' participation.

Taking the requirements and the characteristics of Internet technology together into consideration, a model for in-service teacher training on the Internet is proposed (Fig. 1). Five components constitute the model. They include:

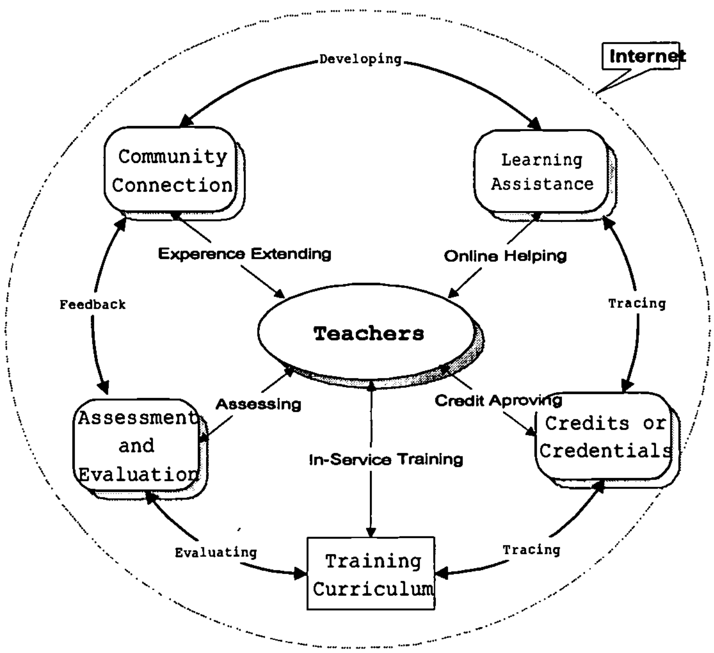
Training curriculum: Curriculum delivered and distributed through the Internet could save more time, money, and manpower than traditional training. Furthermore, the use of multimedia in the Internet-based training curriculum would be more attractive. Concerning the development of the curriculum, it should fulfill the needs of teachers. Not only educational specialists and administrators but also experienced teachers should participate in the development. In addition, the curriculum should be updated frequently, so that it can respond to the changes in society and information.

Learning assistance: It is necessary to provide guidance and assistance in learning directions and technical problems for teachers during the training process because training on the Internet usually is self-paced.

Community connection: Through Internet technology connections, teachers can communicate with other professionals or teachers outside the schools. They can also obtain assistance from resource personnel or join projects or activities held by schools, government agencies, teacher institutes, or social service agencies.

Assessment and evaluation: Assessment can supply necessary feedback so that a teacher can progress in the right direction. Assessment can also serve as the basis to identify the quality of teacher learning. Moreover, assessment can supply useful data for reconsidering or amending the design and implementation of an in-service teacher training plan or program.

Fig. 1 Model for in-service teacher training on Internet



Credits or credentials: Motivation is important for teachers to actively participate in training. Giving credits, credentials, promotion, or raises in salary are incentives for teachers to participate in in-service training. Teacher training using the Internet can automatically provide the results of assessment as a basis for establishing a teacher's qualifications. The qualification can also be further validated by some objective tracing data.

In-Service Teacher Training System on Internet

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A supporting system (Fig. 2) is necessary to accomplish the concept of in-service teacher training on the Internet. Based on the model described above, such a system should have the following functions (a) to deliver training curriculum, (b) to provide learning assistants, (c) to facilitate connections with communities of educational professionals, (d) to evaluate teachers' learning, and (e) to give credit for teachers' achievements. These functions could be supported by different information systems. These five subsystems do not "stand alone." They must be collaborative to support one another. These subsystems may be aggregated under a login interface. Users then can assess these five functions. In addition to the five major subsystems, a user management system is also necessary in order to manage teachers' involvement.

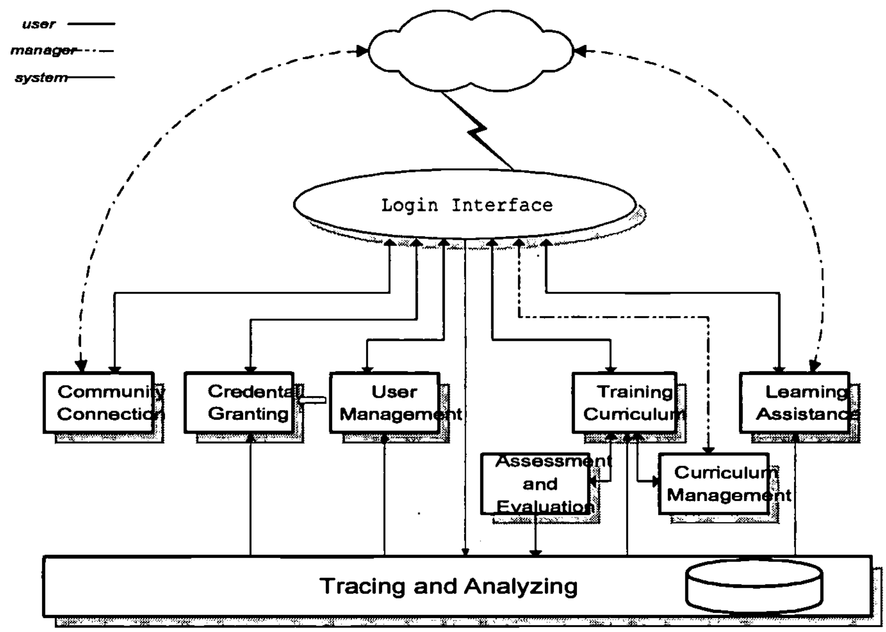

Fig.2 In-service teacher training system on Internet

Subsystem for training curriculum: This subsystem should provide various curricula for teacher training. The content should primarily contain domain and education knowledge. Each unit can be presented by various media, such as text, sound, image, picture, real audio, VR and IP/TV. Teachers can choose the content or presentation style depending upon need or preference. To track a teacher's learning progress, some designed codes can be embedded within the training materials (to be used for *a tracing and analyzing subsystem*). Information such as how long a teacher spent in a work or on a page could all be recorded. In order to manage various curricula, a *curriculum management subsystem* can be useful in helping with developing, modifying, updating, and maintaining curriculum content.

Subsystem for learning assistance: This subsystem can provide assistance to teachers in using the training system or for direction in locating resources. It can also supply some cognitive tools, such as electronic notebooks, concept mapping tools, and so on.

Subsystem for community connection: This subsystem could facilitate interaction among teachers and other professional groups. Using tools such as e-mail, chat, broadcasting boards, or video conference, teachers can communicate, share ideas, and discuss problems with others outside of the school, educators, scientists, specialists, and other teachers.

Subsystem for assessment and evaluation: This is basically a testing system. It could give achievement tests and be able to score, analyze, explain, and give feedback automatically and immediately. In conjunction with the *tracing and analyzing subsystem*, teachers' achievement can be more objectively evaluated.

Subsystem for credential granting: This subsystem has three major functions: (a) using information from the *tracing and analyzing* and *user management subsystems* to credit teacher's achievement, (b) using the *user management* and *tracing and analyzing subsystems* to validate teacher's credits in response to teacher's applications, and (c) producing credentials in response to teacher's request. Compared to the traditional

approach, to validate credits by machine (system) seems more objective, can decrease staffing burdens, and reduce the possibility of human error from complicated administrative procedures.

Subsystem for user management: To manage teachers' involvement, a *user management subsystem* is necessary. It records basic information and learning progress for each teacher. When a teacher logs in, it provides identification procedures. The teacher then can query about his own learning progress. When the teacher logs out, the learning information is recorded and analyzed by the *tracing and analyzing subsystem* and fed back to the *user management subsystem*.

Login interface: The interface provides directions and a menu for using the system, and initiates the *tracing and analyzing subsystem* for recording the users' learning progress. The functions are further described as follows:

1. This interface allows old users to login and new users to register. The login could start the *tracing and analyzing subsystem*.
2. This interface provides Information about the training curricula and related resources for teachers' reference.
3. Through interface, the *user management system* could be invoked. A teacher can then query and modify Individual information. Learning progress could be prompted to the teacher after login, or be checked by request of the teacher.
4. Interface could lead teachers to use the *learning assistant subsystem* to progress through the training program.
5. Interface could lead the curriculum developer/manager through the *curriculum management* subsystem for modifications of the curriculum.
6. Through this interface, teachers can use the functions of the *community connection* subsystem for contacting other educational professionals for joining their projects or activities.
7. Through this interface, teachers could request credits or credentials from *the credential granting subsystem*.

Conclusion

To ensure the quality of in-service teacher training on the Internet, five components are necessary (a) training curriculum, (b) learning assistance, (c) community connection, (d) assessment and evaluation, and (e) credits or credentials for teachers. Based on these requirements, this paper proposed an Internet-based in-service teacher training system. Building such a system according to present Internet technology is quite possible. However, there exist some obstacles to implement in-service training on the Internet for most K-12 teachers. K-12 schools usually do not have enough money to support a network environment with fast computers (e.g., T1□ATM□ADSL ... etc.). In addition, the technology literacy of most teachers is still not adequate enough [Marx, Blumenfeld, & Krajcik 1998]. However, as network technology develops even more rapidly, it can be expected that faster mediums will be developed, easier techniques will be forthcoming, and the costs for network communications will decrease. With the advent of new and more economical network medium, schools will be able to afford the expense of networking, and teachers' technological capabilities will not be a concern. At that time, the obstacles will vanish and the ideal of in-service teacher training on the Internet will be realized.

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Technology Internships for Graduate Students

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Abstract: Teacher education is a developing arena in which technology plays a primary part. Technology is an area that has historically been a strong midstream career change subject area, through which career changing persons enjoy a feeling of rebirth or classroom teachers move towards a teacher training level within their careers. Although technology is an exciting field, graduate students who are new to the technological realm would benefit from internships within their subject areas of interest.
A discussion of real-life experiences of graduate students who have made such a transition through technology internships is a valuable commodity that should be further developed. The discussions between the graduate student technology interns, field-based technology internship director and university faculty member are invaluable areas of information that would be beneficial to expand the knowledge and importance of such experiences.

Introduction

Internships within the instructional technology masters program offer a capstone experience to the students that offers the real-world experience within a safe, temporary environment. Technology internships for graduate students offer numerous opportunities to not only learn about different technological areas within a short period of time, but the students also obtain learning experiences that will allow them to knowledgeably decide upon future endeavors and opportunities that will be available to them. One of the most important opportunities, as perceived by the students, is the ability to network with other students to not only develop working relationships, but also to obtain information upon job opportunities within the educational as well as business and industry arenas. Graduate students in the programs do network while in the instructional technology program and obtain useful information concerning not only career opportunities, but also internship opportunities. Although the faculty obtain useful lists of educational institutions and business organizations that are interested in offering internships to the instructional technology students, the students have available to them many more opportunities due to their network of fellow students.

The students also develop clear understandings concerning positive internship opportunities as well as areas of concern when considering the internship route for their capstone experience within the masters program. Overall, numerous positive views of the internship opportunities are mixed with concerns over their chosen internship opportunity.

Positive Internship Opportunities

The positive internship opportunities were strongly stated by the students within the instructional technology masters program. The students believed that the real world experience would not only enhance their previously acquired skills, but the students were looking forward to the opportunities that would be available to them to learn new skills.

Learn New Skills

The students stated their interest in acquiring new skills that would make them more marketable in the workplace. Whether the students were interested in the realm of education or leaned more towards business and industry, they were most concerned with whether they would walk away from the internship period with real-world skills that they did not previously obtain.

New Environment

Students were quite interested in obtaining experiences in different areas from their previous careers. Most of the students in the instructional technology masters program at the University of Houston – Clear Lake held full-time career positions within the community and were interested in delving into a new situation during their internship time period. Basically, the students fell into two categories of internships: moving from the classroom environment to educational administrative positions, moving from school district educational environments to business and industry environments.

From the Classroom to Administrative Positions

Numerous students within the masters program are classroom instructors, with numerous years of professional experience that they bring to the masters courses. Although the masters students with such skills sincerely enjoy their classroom experiences, specifically working with their classroom students on a daily basis, some of the masters students are interested in working at a higher level within the school districts. These students are interested in obtaining real-world experience concerning the expectations, workload, and possibilities at more of an administrative level within the school districts. These masters students find the internship opportunities to be useful to not only obtain this experience, but also to present themselves to the district on a different level through which their skills will also shine. This internship opportunity not only offers the students the opportunity to work at an administrative level, but it also offers the school district the opportunity to see the superior work that the students can display while working at an administrative level.

From Education to Business and Industry

While numerous students are interested in remaining in the school districts, a significant majority of students with classroom experience are interested in moving from the educational arena towards more of a business and industry career. The skills that the classroom teacher displays are important, desired and marketable skills within business and industry. Yearly, numerous education instructors are whisked away from the school districts to work in business and industry; specifically in the Clear Lake, Texas, area with not only NASA and petroleum industries being prevalent but also related businesses and industries, trainers that have the ability to instruct classes are in demand. Needless to say, the students interested in internship opportunities within the business and industry arena are easily placed.

Possible Job Opportunities

As previously noted, the instructional technology masters students are in demand within not only PreK-12 education but also business and industry. The students that take internship opportunities are more often than not offered a full-time position at their internship site before their internship requirements are completed. Very few internship opportunities do not offer the masters students full-time positions and, after discussing this issue with the internship sites, have found that there were no positions available at the time of the students' internship semester. The possibilities of job opportunities are definitely positive reasons for the masters students to consider an internship as a capstone experience within the masters program.

Working with Adults

As previously discussed, numerous PreK-12 educators have an interest in obtaining an internship opportunity at either an administrative level within education or in business and industry. One of the reasons behind this shift is the desire of the masters students to obtain experiences working with adults.

Training adults is similar, yet vastly different, than working with students in a school district and some of the masters students desire the opportunity to work with adults to gain this experience.

Internship Opportunity Concerns

Although the masters students clearly articulated the positive internship opportunities available to them, a few concerns still plagued their conversations. The masters students felt that the internship opportunities far outweighed the concerns associated with the internship capstone experience; however, the concerns are perhaps as important as the positive opportunities.

Obtaining an Internship Position

One of the first considerations for masters students considering an internship as a masters capstone experience is exactly what type of experience that would be beneficial. The student must delve deep within their true feelings and desires to decide exactly what type of internship they would require, in order to meet the goals they have set for themselves. Once this difficult journey has been traveled, the students are ready to look into internship opportunity positions.

Locating an Internship Position

Locating an internship position is a process that may take some time. An internship position must be carefully considered due to the amount of time and energy that will be put into the internship, as well as possible experiences and opportunities gained from their time at the internship site. Although there are lists of internships that are available to the instructional technology masters students, primarily due to the work of the faculty members, students also obtain internship positions through networking with fellow masters students and looking into school district opportunities.

Paperwork Related to Internship

Once an internship position is decided upon between the internship site, the masters student and the instructional technology faculty, the paperwork must be completed to ensure that everyone involved in the internship opportunity clearly understands the expectations and the procedures have been articulated. The paperwork consists of a meeting between the student, faculty member and internship site to discuss the issues and expectations, developing a contract between the three areas concerning products, meeting schedules and hours per week that the student will spend at the internship opportunity. Once these issues are decided upon, the final paperwork for the university must be completed and submitted for approval. Although this is something of a painless process, the masters students' level of anxiety concerning the end result may be quite high during the deliberations. However, this is a necessary element to ensure the level of quality and experience of the internship opportunity.

Level of Work

One issue that presented itself during discussions of the instructional technology internship opportunities was the level of work that the masters students handled through out the internship opportunity. The students found themselves to be working diligently upon at least one product and the realization that the amount of work involved in the development of the product was quite a lot. Although the masters students were concerned at the amount of work that led to the development of the final product, each student stated that the real-world experience of the internship opportunity was invaluable and helped them gain a sense of different careers and expectations within such careers.

Boring Work

A complaint rarely heard from the masters students in the internship opportunities was the boring work that was a waste of time. The masters students with whom I spoke did not feel that their internship was boring; in fact, the students felt that they had opportunities that they would not otherwise had a chance

in which to participate. However, some students had heard from fellow masters students that one or two experiences were rather boring in nature and did not offer them the intriguing look at another career path. Of course, this is always a hazard of the internship capstone, but the faculty members as well as internship sites work towards developing a useful, significant experience for the masters students.

Connection to Student Needs

The students strongly felt that the internship opportunities were desirous to offer them opportunities to fulfill their future career paths and allowed them the safety to work within such a situation without having to commit themselves to a situation for longer than a semester's time period. However, concerns were noted that the internship should be closely connected to the student needs. Through the work of the faculty members, internship sites and most specifically the masters students, the continuous communication that is desired through out the internship process is not only preferred but also necessary. Only through such communication can all parties involved obtain the desired outcomes.

Conclusions

Overall, students believe the internship option is a great opportunity. The options available to the masters students offers situations that would not be otherwise available. Technology is an area that has historically been a strong midstream career change subject area, through which career changing persons enjoy a feeling of rebirth or classroom teachers move towards a teacher training level within their careers. Although technology is an exciting field, masters students who are new to the technological realm would benefit from internships within their subject areas of interest. Through such internship opportunities, the masters students have the ability to not only obtain real-world experiences but also clearly define their future path and goals.

Acknowledgements

I would like to acknowledge the thoughtful, sincere responses I received from the masters students concerning their beliefs and experiences surrounding not only their internship opportunities but also the beliefs and experiences that their fellow students had discussed with them. Difficult questions were met with direct discussions of not only the positive opportunities available through the masters internship capstone experience, but also areas of concern that the students were willing to share. The instructional technology masters students that I have been fortunate enough to work with through out my time at the University of Houston – Clear Lake have presented themselves as being competent within the areas of theory, practice, research and scholarly work. I am honored to have had the opportunity to work with these students and look forward to their positive contributions within the areas of instructional technology, education, business and industry and beyond.

Constructivist teacher education practices: Teaching teachers through TELE-Web

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Teacher educators are constantly striving for innovative and exciting ways to teach teachers about technology. Many current attempts stem from constructivist theories of pedagogy where the teacher guides a student through authentic projects, acting as the "guide on the side" rather than the proverbial "sage on the stage." This presentation documents both the potential of an internet-based learning (the TELE-Web project) environment as well as one such attempt at involving teachers in the actual implementation of that technology project.

TELE-Web was designed to enhance the literacy learning opportunities of students with disabilities. Essentially, the creators capitalized on a successful literacy program (Early Literacy Program) to improve the authenticity of learning activities and to support the literacy development of young readers and writers. In the first year of implementation, there have been strong indications of its effectiveness, although further research needs to be conducted to determine its precise effects on reading and writing achievement.

TELE-Web consists of a set of server side software and client-side plug-ins that work with a Web server and database applications. The program offers a suite of multi-functional tools in an integrated fashion for teachers and students to use within a Web browser. It enables teachers to adopt, develop, manage and share multimedia literacy materials, as well as to initiate, conduct, and manage collaborative learning projects. In addition, teachers and researchers can archive students' reading and writing responses in order to observe, monitor and report students' literacy performance. Within this environment, learners are enabled and encouraged to explore, experiment, and experience independently and collaboratively with their peers from the same school or from a school afar. Tools are also provided to help students develop performative abilities in reading and writing, in addition to the meta-cognitive skills related to becoming goal-oriented, self-regulatory, independent learners.

There were four central environments that formed the core of TELE-Web: the Writing Room, Reading Room, Library, and Publishing Room. Each of these environments had a teacher and student interface which allowed teachers and students to create assignments; students to create, revise and complete assignments; teachers and students to add on or to comment on other students' work; and the students to read other students' stories. What was unique in these various environments, was the opportunity for students to receive cognitive and social support in each environment, insofar as the cognition and cultural capital and artifacts were distributed across the whole network in TELE-Web (Salomon, 1993).

The TELE-Web project was also unique in that it afforded teacher involvement during the implementation of the project rather than in the final instructional phase of use. Many technology implementations include teachers only in the training of the use of the product. This project attempted to initiate a dialogue between teachers and developers in its implementation. Bi-weekly meetings and other forms of electronic communication revolving around the development of the product replaced any formal training sessions. In turn, TELE-Web not only benefited from multiple voices, but it also presented a new model of instructing in-service teachers.

It is hoped that a round table at the SITE 99 conference would provide a forum for further discussion about new and exciting ways to involve current teachers in technology adoption and innovation implementation such as evidenced by the TELE-Web project. Further, it would provide an arena for the presentation of an internet-based learning environment—one that could be used in any educational environment (K-12 to College).

Turning Educators into Hypermedia Authors: Pedagogy, Decisions and Lessons Learned

This poster presentation will examine and explore the design and development of a workshop for K-12 teachers. The half-day workshop's purpose was to teach people with minimal exposure to computing and the Internet how to develop an educational website using Hypertext Markup Language (HTML). The specific subject matter was meteorology with emphasis on hurricanes and tornadoes.

The usage of a full range of media was introduced including MPEG video, sound files, graphics and text on a web site comprising a half dozen pages.

The teachers were shown how to incorporate media files and build pages in a logical fashion with particular emphasis on the pedagogical impact of the final product. As each portion was taught, audience members immediately created the appropriate portions so that the workshop was extremely practical with a large degree of hands-on experience.

Teaching American History Utilizing Digital Resources in a Rural School District

Abstract:

This project builds on a growing partnership between Frontier Regional / Union #38 School Districts, the Pocumtuck Valley Memorial Association, with a nationally recognized historical Museum and library, and the Center for Computer Based Instructional Technology (CCBIT) at the University of Massachusetts, Amherst. This partnership is collaboratively developing curriculum using local primary sources and artifacts and will digitize resources to make them available to the classroom via the *Turns* web site.

The efforts of this project will result in significant curricular and teaching improvements in American history. Planning for the use of on-line resources, particularly having teachers design how to bring the resources of a history museum into their classroom, has tremendous potential to make history come alive in the classroom. This model of a close partnership between a school and local history museum is one, which can be replicated, nationwide and holds great promise for improved teaching and learning of humanities.

Overview

Turns of the Centuries is a history curriculum project that harnesses the interest and excitement created by the approaching turn of the millennium. This project extends the Pocumtuck Valley Memorial Association museum Memorial Hall's collection of photographs, books, newspapers, and related artifacts directly into the classroom via the Internet. The curriculum will be the product of teachers, scholars, and museum staff working together over a three-year period. This project is the joint effort of the Pocumtuck Valley Memorial Association (PVMA), a nationally recognized historical Museum and library; teachers and other educators in a rural school district, Frontier Regional/Union #38 School District in Western Massachusetts; a film/radio production company, Straight Ahead Pictures; a parent/teacher community group, Deerfield Arts Partnership, Greenfield Community College, and the Center for Computer Based Instructional Technology (CCBIT) at the University of Massachusetts/Amherst. A unique aspect of this project is the grass roots participation and ownership by the teachers and other collaborators who are implementing the project. The plan for building this curriculum was constructed directly by participating teachers and educators during a year long planning period.

During the 1997/98 academic year the school and Museum collaborated on a National Endowment for the Humanities Focus Grant sponsoring a seminar series to engage project participants in the study of American history with a local perspective, focusing on the time periods of the four turns of the centuries. Upon completion of the seminar series, the participating teachers and museum staff commenced developing curriculum material that use primary resources from the Museum's collections. The Museum staff has been selecting artifacts and primary source documents to scan in preparation for the curriculum and resources to be delivered via the Internet to K-12 classroom. CCBIT has been working in an advisory capacity to assist teachers and Museum staff in the use of digitized resources and in designing effective computer delivered curriculum and resources.

We continue to expand on this work in preparation for full integration of computerized resources into the teaching of American history in K-12. The timing is excellent; the Massachusetts Social Studies Curriculum Frameworks have recently been completed. This project will create a blueprint for revamping the American history curriculum to meet the Frameworks. The revised curriculum will include incorporation of digitized resources and academic material to enrich students' knowledge and understanding of American history. A core group of teachers and school librarians are being trained in the use of digitized resources. These educators will also have the powerful experience of designing digitized curricular materials that meet the needs of their specific classroom needs. This project will assist teachers incorporating the use of primary into their classroom curriculum. Training will focus on how these resources can be used to improve the teaching and learning of humanities. The efforts of this project will result in significant curricular and teaching improvements in American history, a subject that is studied by every student in the Frontier Regional/Union 38 School District.

This project plans to formally embed digitized resources (both existing resources and those created by the teachers) in the K-12 curriculum. Planning for the use of on-line resources, particularly having teachers design how to bring the resources of a history museum into their classroom, has tremendous potential to make history come alive in the classroom. The resources these teachers design will be of great

interest to other schools in New England and nationwide. This collaboration will develop an exemplary model of teachers working in partnership with a history museum to bring exciting primary resources into the classroom. This model of a close partnership between a school and local history museum is one, which can be replicated, nationwide and holds great promise for improved teaching and learning of humanities.

Educational Goals

This project will result in improved curriculum and teaching of American history in a rural school district in Western Massachusetts. The Frontier Regional/Union 38 School District is currently engaged in fully implementing their technology plan that emphasizes the integration of technology into curriculum. The school district is currently reviewing the recently adopted Massachusetts Social Studies Curriculum Frameworks. Tests that will evaluate students' performance in these areas have recently been created. The Frontier Regional/Union 38 School District is revamping the American history curriculum to align with these new curriculum Frameworks.

In jointly developing the *Turns of the Centuries* curriculum using primary resources (documents and artifacts from the Museum), the *Turns* project creates a forum for teachers, school librarians and administrators, and Museums staff to work collaboratively. A core group of educators is being trained in the use of available digital resources (CD-ROM or Internet, such as *Valley of the Shadow* and *New Deal Network)* in the teaching of history in a student-centered curriculum. The teachers are concurrently engaged in the powerful experience of designing digital resources that especially meet the needs of teaching history in their district (*Turns of the Centuries)*. They are working closely with the history museum and library to select primary resource material that will enhance curriculum and the teaching of history through primary sources, including material culture, manuscripts, printed documents, and historic photographs in the nationally recognized and extremely well documented collections of the Pocumtuck Valley Memorial Association. Educators are preparing for the integration of on-line Museum resources in the teaching of American history. This approach fosters educator 'ownership' of digital resources that are created and provides strong first hand knowledge concerning the potential value of integrating other high quality digital resources into curriculum. This technique is based on the premise that teachers learn by doing, and as a result they see value and potential in utilizing digitized resources. The experience of creating material will lead them to look toward other digitized resources to enhance teaching in other subject areas.

The humanities themes that we will be developing are central to the six Learning Standards for History in the recently adopted Massachusetts Curriculum Frameworks. Our goal is to infuse each theme and Standard with the **use of primary sources** to create an **awareness of the many and divergent voices** and perspectives that interpret "historic fact". Engaging students in the study of American history by relating to local events and perspectives is a pedagogical approach of the Frontier Regional School.

For example, the First Standard addresses **Chronology and Cause**, the Second Standard highlights **Historical Understanding**, while the Third Standard focuses on **Research, Evidence, and Point of View,** and the Fourth Standard concentrates on **Society, Diversity, Commonality, and the Individual.** Our project will address these Standards through an analysis of the century and a half of interacting complexities of 16^{th}, 17, and 18^{th} century politics, culture, religion, commerce, and ideas of race which led to two early conflicts with the indigenous peoples, conflicts which have come to define Deerfield and by extension much of early colonial American history. The interpretation and "retelling" of these two conflicts, the Bloody Brook Massacre of 1675 (King Philip's War) and the 1704 Attack on Deerfield (a major rallying event of the French and Indian Wars), have gone through generations of interpretative social "lenses". Texts would include the recently released ***The Name of War: King Philip's War and the Origins of American Identity*** (in which the author, Jill Lepore, explores the effects on our history of the ways cultures remember past events) and other 20^{th} century interpretations of the period such as John Demos' ***The Unredeemed Captive*** and Richard Melvoin's ***New England Outpost***. How these wars were interpreted can be explored through earlier interpretive secondary source materials including the 1803 William Hubbard ***Narrative of the Indian Wars in New England***; the 1824 Epaphras Hoyt ***A History of the Indian Wars***; and the 1895 ***History of Deerfield*** by George Sheldon. Primary resources include early 18^{th} century manuscripts and the published works of Rev. John Williams, Deerfield's influential minister whose book ***The Redeemed Captive*** has been in print for 275 years, each successive edition containing Introductions and Explanations reflecting interests and bias of that edition's historic period.

Similarly, these Learning Standards will be addressed by humanities themes suggested by the topic *Hiding in Plain Sight* — how the changing concerns of the dominant culture impacted the enduring Native Culture in New England, how Native self image and public voice have over time reflected the Revolution, Manifest Destiny, the Civil War, etc. We will utilize secondary texts such as ***After King Philip's War: Presence and Persistence in Indian New England*** edited by Colin Calloway and primary materials in the museum's collections, including a newly researched index of Native and African American references in local 18th and 19th centuries newspapers, compiled by PVMA's Native Scholar-in-Residence, funded by the Massachusetts Foundation for the Humanities.

Another example of a theme is *Looking to the Future*, the successive American utopian visions and their projection of present reality and issues on the future. From the commercial utopia envisioned by the early periods of colonization to the Theocratic "City on a Hill" of the Puritans, followed by the refining ideals of the Revolution, the themes of 19th Century Social Reform, and the early 20th centuries commitment to Progress, *plus* our own age's fascination and fear of computer technology, comes an opportunity to create **Interdisciplinary Learning** (Standards 5 and 6)—"literature in history" and "natural sciences, and their effects and influences in the past and present on human life". Among a large body of materials for such a study, the work of our local 19th century author Edward Belay is a prime example. His book ***Looking Backward***, a story of the future in which the reader "looks backward" to the year 1887 from Bellamy's imagined Year 2000, had major impact on politics and social reform in the early 20th century. ***Looking Backward*** has already been identified by high school teachers as a text to add to their curriculum and we will be purchasing copies for students' use in classes.

Other teaching and learning issues in the humanities that are being addressed include critical analysis of various materials and types of evidence: A) interpreting concrete three-dimensional evidence of the past from both the archeological record and surviving objects in the museum; B) improving visual literacy through an analysis of the role of period photographs in recording and interpreting history utilizing PVMA's collection and other Internet accessible historic photograph collections; and C) critically using resources on the Internet by examining factors such as scholarship, bias, and manipulation of images in assessing information.

Planning activities

Beth Terhune, Senior Research Fellow for the Center for Computer-Based Instructional Technology at UMASS, is working with the Frontier Regional/Union 38 School District American history and humanities teachers. Ms. Terhune is a highly qualified historian, teacher training workshop facilitator, and expert in the use of digital resources in the classroom. Ms. Terhune works with teachers to: 1.) Analyze and utilize online resources available for teaching history, through open houses and individual hands-on training available to all middle and high school humanities teachers; 2.) Evaluate different modes of classroom implementation of history web sites and related digital curriculum resources using resources such as Edsitement's featured sites: *Valley of the Shadow*, *New Deal Network*, Library of Congress's *American Memory Project*, and the National Records And Archives Administration's *Digital Classroom*, as well as regionally-oriented sites such as CCBIT's own *Inductive Approaches to History: The Lizzie Borden Trial Case Study;* 3.) Work with core teachers to plan for creation of web-based curriculum resources to be used in their classrooms; 4.) Empower core teachers to design and create 'the museum in the classroom', specifically tailored to the needs of teachers and students. Ms. Terhune will manage deploying prototype teacher designed web-site material to further the process.

Curriculum Development

This project is deeply grounded in the Massachusetts Social Studies Curriculum Frameworks. The curriculum development facilitator working on the project is an expert with these guidelines. The curriculum facilitator is working with the *Turns* to create curricular material utilizing the intellectual material presented by scholars and primary resource material from the Museum. The facilitator continues to guide the development of pilot materials and will ensure that the expanded work throughout the project period meets curriculum guidelines. The district's curriculum coordinator is involved with these efforts also since it is her responsibility to ensure that curriculum meets the new guidelines.

Humanists-in-Residence

The Education Director, Youth Programs Director and curatorial staff at the Museum are serving as a humanist-in-residence to provide the ongoing link between the educators and the museum resources.

Museum staff will work in the classroom, co-teaching elements of the multi-disciplinary high school course and serve as an ongoing resource to all history teachers.

Intellectual Guidance

Dr. David Glassberg provides intellectual leadership and guidance to the project. Dr. Glassberg is the director of the Public History Program and a Professor of History at the University of Massachusetts. He received his Ph.D. in History from Johns Hopkins University and has special expertise in training teachers to teach history using new computer resources. Dr. Glassberg is reviewing digital resources and prototype curriculum and web site materials. He works with small groups of teachers providing consultation as they determine how to best plan for the revision of their American history curriculum. Additionally, Dr. Thomas Doughton, visiting professor at Dartmouth College and University of Massachusetts, is a scholar whose expertise is Northeast Native American Studies and who presented in the seminar series. He works with participating teachers and Museum staff consulting with them on including important humanities concepts in classroom curriculum. In the 9-12 multi-disciplinary course, Dr. Doughton will teach 'side by side' with classroom teachers. Dr. Doughton will consult with core grade teachers as they develop and review curriculum.

Evaluation

Dr. McArthur, who has 10 years of evaluation experience within her 20-year career as an anthropologist, serves as the evaluator for the project. She serves as the evaluator for all grants and has demonstrated her effective hands-on approach by attending all seminars and planning meetings, as well as providing ongoing written and verbal formative evaluation. Her areas of expertise include fostering teacher ownership, the content within the Massachusetts Frameworks, and history. The evaluator attends all meetings to provide formative evaluation material. As a member of the planning team, the evaluator facilitates a collaborative process among representatives of all stakeholders, including teachers and the scholar, Dr. David Glassberg, building an evaluation template, which will name teaching and learning goals and outcomes, and descriptors of anticipated outcomes. Dr. McArthur, as a research associate at The NETWORK, Inc., was on a team that developed template methodology as an evaluation tool. Template methodology has been successfully used for curriculum reform efforts in math and science, funded by the NSF and the US Department of Energy. Most recently, Dr. McArthur has been using templates for evaluation of the Mass. Department of Education's' Consortium For Initial Teacher Preparation, a project promoting curriculum reform in teacher education.

Frontier Regional/Union 38 School District Information

Frontier Regional/Union 38 School District is a K-12 school district with 1700 students serving the rural towns of Conway, Deerfield, Sunderland, and Whately in Franklin County in Western MA. Franklin County is the poorest and most rural county in Massachusetts, with a population of just 70,092. 27% of adults in Franklin County over the age of 18 do not have a high school diploma. Family incomes in all four towns served by Frontier Regional School falls below the state average. The poorest town, Sunderland, has an average income under $33,000 for a family of four, and 28% of the children are on free/reduced lunch. 18.5 % of students receive special education services. Minimal public transportation and rural isolation characterize these towns. Schools are supported well within town budgets. The five school buildings making up the district have all been constructed since 1989 and a state-of –the-art technological infrastructure exists. (These renovations have been key to the schools' technology implementation plans.) All of the construction projects have been funded by Massachusetts 'School Building Assistance Bureau (SBAB), local town funding, Department of Education Technology Challenge grants and significant donations from local businesses. All classrooms and administrative offices are equipped with computer stations and printers, and are fully networked with a Wide Area Network (WAN). A T1 line provides full Internet access. In addition, there are computer labs with workstations, printers, scanners, and projection units. Each of the school's library media center has fully-networked multi-media workstations with various peripherals including, color printers, digital cameras, and scanners supporting group and individual research projects. The district's technology coordinator works to ensure those technology resources are integrated into curriculum through teacher training and resource development.

The school district is in an excellent position with superior technological resources. Throughout the project we have assessed how teachers are using the new technological infrastructure. Frontier Regional's technology coordinator monitors the needs and next steps necessary to fully utilize digital resources in the classroom. We ultimately plan to have teachers linked electronically to the Pocumtuck Valley Memorial Association so that they may request resources and have these resources immediately transferred back to the teacher requesting the material. PVMA's technology resources will be assessed in the planning period, assisted by the Center for Computer Based Technology and Frontier Regional District's Technology Coordinator. A plan for acquiring necessary resources will be formulated.

School Commitment

There is deep commitment by school personnel to this project. This project builds on the recent humanities focus grants that establishes a partnership between the Frontier Regional/Union 38 School District and the Pocumtuck Valley Memorial Association with the goal of improving the teaching of history.

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Teaching Educational Technology Using a Cohort Program Design – Does it Make a Difference?

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Abstract: Research studies have revealed that students who are in a supportive, less stressful environment and are actively involved in the instructional process tend to be more academically successful. This paper will describe the impact of an educational technology graduate program using a cohort group model and whether the cohort program provided support to students during their graduate program, provided a less stressful learning environment, and assisted teachers in the successful integration of technology into their classrooms.

Introduction

Creating new opportunities for K-12 teachers to learn technology has been the focus of much discussion in colleges of education (Woodrow, 1998). Due to the increase of computer technology in K-12 classrooms, teachers are entering graduate school to learn the technological skills necessary to integrate technology into their classroom curriculum. Many teachers have built-in anxieties and lack confidence in using computer technology, thus making their graduate school experience even more stressful. Specifically, adult students, who are classroom teachers, are reporting that reentering the academic arena is a stressful and sometimes overwhelming experience (Gunter & Murphy, 1995, Murphy & Gunter, 1997).

Research studies have revealed that students who are in a supportive, less stressful environment and are actively involved in the instructional process tend to be more academically successful (Schwartz & Beichner, 1999). Graber (1996) identified the cohort group design as one variable that influenced students' perceptions and positively affected their progress through courses. The cohort design was recommended as a way to create a teacher education program that could strongly influence graduates' teaching beliefs and success. A cohort consists of a group of students who enter a program of study together, completing a series of common learning experiences over a period of one to two years (Barnett & Caffarella, 1992). The cohort program design supports the philosophy that students need to connect with one another and work together as a team to have a more favorable educational experience. Cohort groups support student learning and lay the basis for networks that might benefit students as they continue their profession in their schools and school systems (Teitel, 1997).

This particular pedagogy lends itself well to teaching technology-based courses. Technology in itself can be an overwhelming and intimating factor for students. Knowing this, a program design should be adjusted to meet the needs of K-12 teachers entering the graduate school environment. Many teachers in K-12 schools do not have the training necessary to integrate technology, including the prerequisite skills of how to use technology (Robyler, Edwards, & Havriluk, 1997). Training conducted in a non-threatening manner that compels teachers to discover and investigate technology applications for the classroom can help overcome the fear and anxiety often associated with technology.

The purpose of this qualitative pilot study was to investigate the phenomenon of graduate students enrolled in a two-year educational technology master's degree cohort program and examine its overall impact

on their coursework and degree completion. The study will examine whether the cohort program provided support to students during their graduate program, whether the cohort group provided a less stressful learning environment, and whether a cohort program could assist teachers in the successful integration of technology into their classrooms.

Background and Methodology

The Educational Technology Master's program at the University of Central Florida was designed in 1995 to provide classroom teachers with the technology skills needed to apply the principles of educational technology to the teaching and learning process. In addition, the master's degree allows students to develop the leadership skills necessary to become site-based technology coordinators in the K-12 school environment. The program was designed using guidelines from professional organizations, primarily the Association of Educational Communications and Technology (AECT) and the International Society for Technology in Education (ISTE). Educational technology as a field of study is a complex, integrated process involving people, ideas, technology tools, and strategies applied to human learning. The educational technology program includes the study of communications, the process of instruction and learning, the study of theoretical knowledge and scientific principles, and the complete understanding of technology integration in the classroom. Research has shown that using a cohort design is an effective way to design a new graduate program (Graber, 1996; Teitel, 1997), thus the educational technology program was developed as a cohort group design.

To evaluate the cohort design, students completing the educational technology program answered open-ended questions which addressed the overall impact of the cohort experience as well as the students' various experiences during their graduate studies. Seventeen of the 25 teachers completed the open-ended questionnaire for a 68 percent return rate. The survey asked students (1) to describe how the cohort program enhanced their professional life and personal life, (2) to describe the students' relationships and conflicts with peers in their cohort, and (3) to describe students' opinion and feelings about their overall experience working within a cohort. Students' individual responses were summarized with preliminary conclusions presented.

Findings

Three areas of impact of the cohort group design stood out in the survey responses. The first was the networking, support, and cohesion, which occurred as a result of the cohort. The second area involved conflict within the group and how individual students dealt with that conflict. The final area of impact dealt with the enhancement of the students' professional life as a result of completing the cohort degree program.

Networking, Support, and Cohesion

Most students identified networking, support, and cohesion as the primary benefits of the cohort group model. The support and friendship from others in the cohort helped students deal with feelings of fear and intimidation associated with the technology field. "Two years ago [when I started the program] I had no idea what I was getting into. I was scared, intimidated (but determined), and I did not know one single person in the group. I now have 27-plus people (professors too) I would feel comfortable contacting at any time, 24 hours a day (email is wonderful) with professional questions and concerns." Support also played a role in reducing the stress related to attending a graduate technology program. "The pressure is high -- being there [in the program] all alone would have provided additional stress."

The support from fellow students was found to be particularly important and played a role in student retention. "Though my husband was supportive, I would have dropped out if it had not been for the group support. I am too old and too busy to deal with this on my own, I really needed the support group, and with it, it was wonderful!" Several identified the cohort group as a "comfort zone" or "support system," and they reported feeling isolated and lonely without the cohort group. "Without a cohort group, I would feel somewhat alienated and disconnected. The cohort has served as a 'family' that provides you with a certain level of acceptance."

Some students did not identify the cohort as necessary to find support or enhance their educational program. In fact, one student commented on the flexibility in a non-cohort program. "I earned an earlier masters

degree without a cohort -- you still end up with a core of people that you know and take classes with -- as you have a common goal and need to take classes when offered. However, there was more flexibility in when you could choose classes."

Conflict Within the Cohort Group

The majority of students reported conflicts occurring in their small group experiences at some point during the two-year program. These conflicts arose as a result of students dominating discussion or not following through on group assignments. Many comments regarding conflicts were about the students who had "stronger personalities." "We are pretty open in our discussions. Sometimes toes get stepped on with conflicting personalities." "The only conflict that arose was the strong personalities in the group who vocally gave the instructor grief."

Avoidance appeared to be the primary method of dealing with conflict within the group. "Conflict only came up on time when one member of my group did not do their part. I handled this by making sure I was not in that person's group again." "I personally just let things that bothered me go in one ear and out the other." "Personally, when conflict arose, I kept quiet." "Personally, I ignored the obnoxious people."

Some groups were able to address their conflicts directly. "Whenever we are grouped, the small groups have been very open with each other about strengths and weaknesses." "I think we resolved any problems with open communication and mutual respect." A few students noted how others would address conflicts first with fellow group members (without the individual whom the conflict was directed), and then he/she would address their concern to the individual. One respondent stated it most clearly, "Most conflict was dealt with in an open manner -- however, there was quite a bit of talking behind the back."

Enhancement of Professional Life

Students noted both the cohort design in addition to the graduate coursework as playing a role in the enhancement of their professional life. "The degree program and the members of my cohort group have exposed me to a wealth of knowledge, all of which is relevant to my profession." "Working with the creative people in our cohort has also helped broaden my understanding of how the 'invisible' integration of technology in the classroom can effectively support student learning." Several students mentioned feeling confidant in the technology field as a result of their cohort experience. "I feel a confidence in my abilities and part of that comes from the support I've gotten from my cohort."

Several students gained job promotions or were hired in technology-specific education positions as a result of their graduate degree program. "With the experience I gained, I have been moved to a technology teacher [position] at a new school. [The school] is a model technology school and gets a lot of recognition for its use of technology." "My experience and knowledge gained by my completing the educational technology program enabled me to be selected as District Technology Trainer this year."

One student attributed her new job offer to a member of her cohort with whom she networked. "One of the members of [my cohort] group is the technology coordinator at my school. She recommended me for the job of telecommunications teacher, co-presented at a conference with me, and has asked me to conduct several in-service workshops. All of this happened because we are in the cohort group together, do all of the group projects together, and she is familiar with my skills and perfectionist attitudes."

Conclusion

Due to the increase of computer technology in schools, teachers are entering graduate programs to learn the skills necessary to integrate technology into the classroom. Support and less stressful environments can help teachers learn technology skills despite the anxieties and lack of confidence they may have about using computer technology. A cohort group design was used in implementing the University of Central Florida's graduate program in educational technology. This approach was established to create a learning environment in which students can connect with one another and work together as a team to have a more favorable and successful educational experience.

The benefits of the cohort program were clearly demonstrated by the majority of students' remarks on the program evaluation. The primary benefit of the cohort program was the support from classmates. The networking, support and cohesion provided by the cohort design was credited for helping students cope with feelings of fear, intimidation and stress associated with the technology field. The majority of students reported conflicts occurring in their small group experiences. Conflicts were either avoided or dealt with directly. Enhancement of professional life became a positive outcome of the cohort design. Students acknowledged the cohort design in addition to the coursework as the reason for attaining new technology-related positions and job promotions. Students also described feeling much more confident in their technology abilities as a result of their cohort experience.

Overall, it appears that the cohort group design was successful in helping teachers learn to integrate technology into the classroom. In a field of study that can generate stress and intimidation, the cohort design provided teachers a less stressful learning environment resulting in feelings of support, confidence, and self-assurance in their technology abilities. The results of the study, showed that the Master's of Educational Technology cohort program at the University of Central Florida was a success in providing an environment for student collaboration, a cohesive group, and built personal and professional relationship in the field of educational technology.

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Restructuring Teaching with Technology and Constructivism

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Abstract: Professionals from the Technology Assistance Program (TAP) of the Southwest Education Development Laboratory (SEDL) discuss one of their projects, *Applying Technology to Restructuring and Learning*, in this panel session. The project focuses on creating technology assisted constructivist learning environments and is being currently being carrying out in 6 schools within SEDL's five-state region (Arkansas, Louisiana, New Mexico, Oklahoma, & Texas) with 150 participating teachers. The panelists share experiences, insights, and emerging models that K-12 and higher education educators can replicate for creating constructivist learning environments supported by technology.

Introduction

The *Applying Technology to Restructuring and Learning* project seeks to provide replicable models of constructivist learning environments (CLEs) supported by appropriate technologies, in schools with highly diverse student populations. For the purposes of this project, technology is defined as computers, whether alone or in combination with other hardware, software, or networks. The work of this project is anchored by six principles of constructivism synthesized from a review of the literature. These principles emphasize making explicit the prior knowledge, experiences and beliefs that students and teachers bring to a learning situation, and scaffolding the process of individual and social construction of new knowledge.

The objectives of this project are based on work in the field and are as follows: 1.) Develop and provide assistance in planning for and creating classrooms that are constructivist learning environments supported by technology. 2.) Document the classroom experiences of teachers and students in low-achieving schools that have predominately poor and/or minority student populations as they create CLEs supported by technology. 3.) Scale-up the creation of CLEs supported by technology to other classrooms and schools in SEDL's five-state region. 4.) Create models of CLEs supported by technology based on the experiences of teachers in classrooms at site schools and scale-up sites. 5.) Disseminate awareness-level information about

these models and the process of creating a CLE supported by technology as it emerges over the course of the project.

A Constructivist Framework

There is a great deal of talk about "constructivism" these days - in workshops, in articles, and in books. There is also a great deal of discussion across the nation about school reform and how technology can support that reform through relevant problem-solving, concept development, and critical thinking activities.

While research suggests that use of technology in classrooms is most effective when used with constructivist instructional strategies, it's not always clear what the abstract principles of constructivism look like in a classroom setting. How can educators apply these abstract concepts to their classrooms?

How does one get started on the path of creating a constructivist classroom supported by technology? How can a teacher redesign classroom activities to meet curriculum standards and requirements while at the same time creating constructivist learning environments supported by technology? More importantly, how can university professors, in teacher education programs, redesign their own instruction so that it models constructivist practices that their pre-service teachers are expected to implement?

Six principles of constructivism synthesized from a review of the literature provide the framework for the development and implementation of all phases of this project. These principles acknowledge that learners bring unique prior knowledge, experience, and beliefs to a learning situation. Knowledge is constructed uniquely and individually, in multiple ways, through a variety of authentic tools, resources, experiences, and contexts; learning is both an active and reflective process; learning is a developmental process of accommodation, assimilation, or rejection to construct new conceptual structures, meaningful representations, or new mental models; social interaction introduces multiple perspectives through reflection, collaboration, negotiation, and shared meaning; and learning in internally controlled and mediated by the learner.

Several staff development modules were developed to introduce teachers to the conceptual framework of constructivist learning theory and how the infusion of technology supports teaching and learning. These modules provided the opportunity for teachers to participate in a constructivist learning experience supported by a computer software application. Learning a software application was embedded in each of these modules to model practices that teachers can use in creating a constructivist learning environment in their classrooms.

Designing for Instruction

Over 1998-1999 school year, several classroom models emerged that can be replicated for incorporating technology and constructivist teaching practices into the classroom. These models indicate that the most successful constructivist learning environments supported by technology are designed around a curricular topic rather than concentrating on learning a computer application. Instead, computer technology is woven into each model as a tool to enhance the learning activities and becomes just one part of a project rather than its main focus. The SEDL/TAP team found that when the emphasis is on a curricular topic and that teachers can learn from students, classroom teachers are more likely to try computer technologies in their classroom.

The instructional models that emerged fit a variety of settings -- a one-computer classroom, a classroom with 2-4 computers, or a computer lab Instructional strategies include working individually, working in pairs, working in mall groups, and working in larger collaborative groupings to accomplish single tasks or trans-disciplinary activities.

Three additional innovative models emerged. One is called the "Navigator" model, another called the "Expert" model, and the third is called the "Active Learning" model. All three models show how a group of students can learn a new technology application while researching and developing project content. In all three models, students accept a variety of rotating roles and responsibilities and share with the rest of their project group or work team. The teacher becomes a facilitator for learning and provides expert support but is not the sole source of information or expertise. In these models, students become active learners and learn computer technology at a pace that suits their needs.

Summary

The fieldwork for the *Applying Technology to Restructuring and Learning* project will continue at the same sites into the 1999-2000 school year with the same participating teachers. The focus of the project will continue to be demonstrating and modeling a variety of ways to organize for learning with constructivist practices, observing and helping teachers implement these new practices in their classrooms, while at the same time assisting teachers explore a variety of software tools. Guided reflection on these learning experiences will be used consistently to scaffold teachers' construction of knowledge about new roles and practices and the process of applying these ideas in the classroom.

Faculty Development: Integrating Technology into the Classroom

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Abstract: Technology use in the classroom is often less than what it can be. Teachers remain as the primary implementation engine to advance the use of computers, but they are often struggling with more fundamental needs such as how to run the operating system and use a specific program at rather low levels of functionality. These same teachers often have training opportunities that are piecemealed together in an afternoon workshop or hour-long professional development sessions that have not focused on the specific needs. This paper focuses on a process to overcome some training inadequacies and measure the success rates of teachers as they more fully integrate technology into the classroom.

Introduction

In the state of Missouri, a growing level of funding — local and state, public and charitable — is being directed to meet the instructional technology needs of K-12 schools. However, a similar level of investment in teacher training to take advantage of these new resources is an essential component that limits full utilization of the technology investment. This disparity threatens the ability of school districts, especially those with significant per capita technology investments, from adequately preparing their students for post-secondary education and the workplace of the 21st century.

With breathtaking speed, technology skills are becoming commonplace and essential throughout American society. Teachers who are not proficient in such skills cannot properly integrate technology in the classroom or communicate its importance to students. Future employees who lack such skills cannot compete for well-paying jobs that may not even exist today. The reality in 1998 is that teachers are often slow to embrace technology in their teaching. Teachers find it time-consuming to learn how to use technology and intimidating to fully apply technology tools with their students.

Typically, students are more familiar and comfortable with technology than their teachers are. Young people who have grown up surrounded by new technology tools that touch all aspects of their lives do not even see computers, video games, the Internet, cellular phones, voice mail, electronic schedulers, home alarm systems, and the like as "technology." They see this equipment as birthrights and as such assimilate it into everyday lifestyles. Much as babyboomers embraced televisions and stereos and generation X embraced cars VCRs and rack stereo systems, echoboomers anticipate assimilating with computer technology as no preceding generation has. These tools are just an accepted and understood part of their environment.

A growing body of academic research confirms the critical importance of teacher competence in a variety of technology-related skills and the gap between that goal and the reality of most school districts across the nation:

- "There is considerable expectation that computer technology could have a major impact on improving the educational system" (Marcinkiewicz & Regstad, 1996 p.27).
- "...the actual state of computer use in education differs from the expected one; relatively few teachers have integrated computers into their teaching, despite increased availability" (Marcinkiewicz & Regstad, 1996 p.27).
- "A survey by Sheingold & Hadley (1990) indicated that only about one teacher per school had integrated computers into their teaching, despite the fact that the number of computers available (59) was more than

double the national average of computers available (26) for schools." (cited in Marcinkiewicz & Regstad, 1996 p.27).

- "Staff Development and teacher education programs may improve their effectiveness if they take into account teachers' subjective norms for computer use" (Marcinkiewicz & Regstad, 1996 p.31).
- There is increasing use of technology in classrooms but it lags behind usage by business. Technology and cyberspace are native to the culture among today's school age students. Adults often remain aliens in cyber-culture. Teachers are more likely to prefer to work with the computer they are trained on (Pardamean & Slovaceks, 1994-95)

Technology-related training is not only "good for" teachers, it is recognized as a priority training need by mid-Missouri teachers. In 1997, Horizon Research Services conducted a statewide survey of 1,700 teachers for the Missouri Department of Elementary and Secondary Education (DESE). The professional development issue with the highest mean likelihood of participation for Region 9 (the University's service area) was "training in technology and how to integrate technology into the classroom. That issue registered a mean score of 4.0 on a five-point scale.

In February 1998, the University's MATHLINE Coordinator distributed a survey to 24 teachers participating in the MATHLINE professional development project (described below). Teachers were asked to identify technology workshops and seminars that "would be most helpful" to their school. The highest-ranking responses in rank order were:

- Incorporating the Internet as part of the classroom resources for student use
- Using the Internet to enhance lesson plans as a teacher resource
- Instructional applications for computer use in the classroom
- Integrating the resources of the Internet and instructional video
- Using graphics software such as PhotoShop and Adobe Acrobat

These surveys confirm that teachers — especially those in small, rural, and isolated districts — are hungry for technology-related training opportunities.

The process of training teachers to incorporate instructional technology in their classrooms relies on the same principles that guide any other type of professional development. As described in the Missouri Professional Development Guidelines for Student Success, such training should enhance a repertoire of skills and content knowledge, involve active learning processes, lead to improvement in teaching practice, help students to become more efficient learners, and be consistent with the school district's professional development plan.

In response to the need for increased teacher training in technology-related issues and the opportunity to leverage current school district investments in technology infrastructure, a professional development program is essential. Its purpose is to:

> Provide K-12 teachers with on-site technology-related training that will (1) prepare them to confidently develop computer, telecommunications, and instructional software applications in their classrooms, and (2) build networks of support for technology investment and technology training among teachers, administrators, school board members, and parents in participating school districts.

The design of this proposal is based on the following principles of best practice in educational instruction:

- Collaborative learning — Teachers work both alone and in teams at a computer station
- Hands-on learning — Training is practical, professional, with clear outcomes for the participants
- Production oriented — All participants produce prototype curriculum modules leading to best practices in using technology in instruction
- Focus on a "community of learners" — Teachers learn from and with their peers so that a familiar support network is in-place once the formal training ends.

The project is further grounded in the "Foundation Technology Standards for All Teachers" developed by the International Society for Technology Education:

1. . Demonstrate ability to operate a computer system in order to successfully utilize software.
2. Evaluate and use computers and related technologies to support the instructional process.
3. Apply current instructional principles, research, and appropriate assessment practices to the use of computers and related technologies.
4. Explore, evaluate, and use computer/technology-based materials including applications, educational software and associated documentation.
5. Demonstrate knowledge of uses of computers for problem solving, data collection, information management, communications, presentations, and decision making.
6. Design and develop student learning activities that integrate computing and technology for a variety of student grouping strategies and for diverse student populations.
7. Evaluate, select and integrate computer/technology-based instruction in the curriculum of one's subject area(s) and/or grade levels.
8. Demonstrate knowledge of uses of multimedia, hypermedia, and telecommunications to support instruction.
9. Demonstrate skill in using productivity tools for professional and personal use, including word processing, database, spreadsheet, and print/graphic utilities.
10. Demonstrate knowledge of equity, ethical, legal and human issues of computing and technology use as they relate to society and model appropriate behaviors.
11. Identify resources for staying current in applications of computing and related technologies in education.
12. Use computer-based technologies to access information to enhance personal and professional productivity.
13. Apply computers and related technologies to facilitate emerging roles of the learner and the educator.

General Description

Six basic technology training modules for classroom teachers in grades K-12 whose schools will be developed. The six training modules are as follows:

1. Incorporating the Internet and instructional video programming in classroom instruction
2. Instructional applications for computers in the classroom
3. Web page design and multimedia
4. Software training: PowerPoint, and Desktop Publishing;
5. Network Development
6. Using the Internet as a resource.

Training will be delivered in a two-stage format during in-service days at participating school districts. Each module will provide at least four direct contact hours of instruction and will generally enroll 10-15 teachers at a time.

Schools can select as many modules as they desire and schedule training on one or more Professional Development days during the year. Training modules will contain a group of common components:

- An introduction with expected outcomes
- Tutorials for system operations in Windows 3.x, Windows 95, Windows 98 and Mac OS
- Tutorials for software already owned by the school district that is the subject of the training session
- An overview of best practices and model projects in the topic area selected
- A self-paced outline for completing each training session

Each of the training modules contains a range of learning outcomes that is stratified to match the requisite skills and knowledge of each participant. Training is designed to accommodate widely varying teacher competencies and comfort with computers and telecommunications. Thus, beginners and more advanced users can both proceed at their own pace through the training activities. This adaptability of instruction is made possible by collaborative learning techniques, cross-level peer instruction, training with familiar in-school equipment, well-trained instructors, and clear expectations and outcomes for each training session.

An ongoing need associated with training sessions is a process to offer workshops to parents and school administrators. Leaving stakeholders out of the training processes undermines the learning that teachers are acquiring. Yet, this idea is generally new and speaks to an integrated holistic approach to learning that is fundamentally at odds with current practice in the schools. Teachers do their job and parents do theirs. Communication and joint projects that are on conference days and when room parents participate in some function. Joint training session in computer technology as adults who partner on a project remains outside normalcy in many Missouri rural schools. The same incipient issues occurring between schools and families in many school functions foster this. Parents and teachers are equally busy as the same time in different locations. Bringing these parties together for joint training sessions without children related activities occupying them in meaningful activities undermines the ability to serve both populations simultaneously. Accountability for teachers in the training sessions revolve around three activities:

- Presentations by teachers on the uses of educational and instructional technology in their classrooms.
- Overviews of model projects developed by local teachers and others to broaden an awareness of instructional technology best practices.
- School district plans and needs for expanded curricular offerings that utilize instructional technology or that teach technology-related skills.

Teachers who complete the training sessions will be asked to participate in the annual DESE Technology Conference and the Show-Me conference. In addition, they will be encouraged to develop best practice lesson activities for their students. It is expected that resulting student prototypes will be included in the conference presentations during poster sessions.

Target Population

The initial target of this project is the 90 public school districts served by the university by the Central Regional Professional Development Center (CRPDC). The CRPDC will serve as a resource in contacting and communicating with Professional Development Committee (PDC) chairs at each school district to establish the dates and locations of training sessions. PDC chairs will assess needs for technology-related training and choose desired modules from a menu of options. Once a PDC chair identifies the desired subject area(s), training will be scheduled on an assigned Professional Development Day or another convenient meeting date that allows for 4-8-12 hours of training.

A significant advantage in working through the Regional Professional Development Centers is their established communications network local schools. They are an accepted vehicle for planning and delivering professional development content. Their regular access to a multitude of school districts also puts them in a unique position to work with school districts that have been cited for academic deficiencies and are developing plans for rectifying those shortcomings.

Conclusion

To date, the training sessions are being conducted much as outlined above. The following data set outlines the frequencies for various training modules during the fall semester.

Session Type	September	October	November
Internet	5	7	5
Productivity tools	0	6	6
Hypermedia	3	6	2

The total number of teachers trained during these sessions is 410. Popularity of the training processes, the obvious need for training, state mandates for training tied to technology grants, and the desire to earn graduate credit on-site all contribute to an increased demand on time and resources to accommodate the teacher requested training. Consequently, an additional trainer will participate in the spring semester on a regular basis and two trainers working in very specific applications will also contribute to the training processes.

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New Meets New: Fitting Technology To An Inquiry-Based Teacher Education Program

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Abstract: The method by which student teachers at the University of Calgary are prepared to meet technology requirements for teacher certification has been made obsolete by the introduction of a new inquiry-based teacher education program. Combined with a new school curriculum, which requires the seamless integration of technology into core subject areas, this has prompted the need to rethink the technology aspect of the teacher education program. A needs assessment based on the new Alberta curriculum was conducted to generate a technology profile of student teachers entering the new program, and to facilitate selecting appropriate means to integrate technology within it.

Introduction

In days of yore the University of Calgary had a very "traditional" teacher education program. It accepted students into a four-year Bachelor of Education program, a shorter B.Ed. after-degree program, and a variety of combined degree programs. Students saw themselves as *students*, and they were treated like *students*; they attended classes on teaching methods, psychometrics, communication, special education, and so on. Common to their experiences was the belief that what they did at the University bore no useful relationship to what happened in the classroom, and they couldn't wait for their practicum experiences when they were able to do *real* teaching in *real* schools. Their academic program was intended to prepare them for teacher certification in the Province of Alberta and this included meeting the technology requirements for teacher certification. Consequently among the courses in their program was EDTS 325: Introduction to Computers in Education—two hours a week of lecture supported by three hours a week in the lab, plus extra personal time required to complete lab assignments and projects. Students who passed through the program gained at least a minimally acceptable level of competence with productivity software, multimedia, hypermedia, communications, and computer assisted instruction, and they were required to muse about these in educational contexts. Those who were intrigued by technology in education were afforded the opportunity to obtain a minor in computer applications by taking additional courses.

This course-based undergraduate program is dead, and from its ashes has arisen the Master of Teaching program. After completing at least one previous degree with a specialization in an area relevant to a school classroom, those wishing to become teachers now enroll in the two-year Master of Teaching (MT) Program offered at the University of Calgary. MT students are assigned to a Professional Seminar, a Case Tutorial, a Field Seminar, a school, and a community/workplace teaching site. They are treated as professionals in the making in a program which describes itself as *learner-focused*, *inquiry-based*, and *field-oriented*. Within five days of beginning their program, students spend a week immersed in their school settings, and for the remainder of their first year they divide their time almost equally between school and campus. The exception is a period of five weeks in which their field experience shifts to some educational setting other than a traditional school: zoo, art gallery, museum, prison, day care, special needs facility, social agency, human resources department, and so on. The academic portion of their program is carried in a series of cases with which they must wrestle weekly. No one student can possibly research all of the issues embedded in the cases, and they soon learn that they are heavily dependent upon each other to gain maximum

benefit from the program. The idea of mutual inter-dependency has been facilitated by removing the private and competitive elements associated with grades, and substituting a credit/fail system that is documented by a series of narrative reports. Those who do not contribute to the common good rapidly feel the heat of peer pressure to actively participate. Field Seminars provide opportunity for cross-fertilization from the breadth of experiences which students have in their various school and community/workplace settings, and to pursue issues arising from their practical experiences. Finally, Professional Seminar provides a forum in which additional lenses may be brought to bear on the integration of theory and practice, and also provide a container to house the independent studies and biographies of learning required of each student. The second year of the MT program is dominated in the first semester by a sustained field experience in a school, and in the second semester by a field-based research project.

A considerable amount of research and careful thought went into making this radical change in teacher education. What was not considered carefully enough in conceptualizing this new program was how to address the needs of students to gain the technology competencies required for certification. That task is now in the hands of the authors of this paper—and there are some constraints! Returning to the formalities of lecture and lab is not an option; the philosophy and spirit of the new program, *learner-focused, inquiry-based, field-oriented,* must be maintained.

New Meets New

The task of developing the technology component of the MT Program is further influenced by a change in the school curriculum within Alberta. The province has decreed that technology in the classroom will not be a discreet affair relegated to the computer lab, but will be integrated within the core school subjects. This new provincial curriculum is contained in a document, *Information and Communication Technology, Kindergarten to Grade 12: Interim Program of Studies* (Alberta Education, 1998), and is due for implementation in the schools beginning in September 1999. Best described as a requirement to teach technology across the curriculum, the new framework emphasizes (1) the seamless relationship between technology and the subject disciplines, (2) the process nature of technology itself, and (3) the co-existence of KSAs for technology alongside those for the subject areas. In large measure it also assumes a constructivist approach to teaching. From the point of view of teacher education, it is not only desirable that students become familiar with the content of the new curriculum; it is also desirable to achieve some methodological consistency between how technology is incorporated within the MT Program and what will be required by experienced teachers within schools to implement the new curriculum.

Finding the means of achieving these goals is presently the responsibility of the authors. We will pause here to include a very brief confession to the effect that our first efforts at addressing the competencies bombed. We organized some drop-in introductory workshops—practically no one came. We commandeered one Professional Seminar time slot, and organized an introduction to electronic information resources available to the campus—half the students loved it, the other half were bored to tears. In the wake of these experiences, we paused briefly, and began to examine our own assumptions. We came to the following conclusions:

1. We only thought we knew our target audience. We were really working from a student profile of students in our old four-year, first-degree B.Ed. program, not a program in which every student has already completed at least one degree.

1□

2. It is inappropriate to assume that repackaging the technology content from the previous program to a new format is all that is required.

2□

3. We need to rethink the implications of skill development within a constructivist framework.

Needs Assessment Methodology

With our assumptions shattered, we went back to basics and conducted the needs assessment we should have considered in the first place. We settled upon conducting a survey as the most appropriate means of (1) gathering baseline information from Master of Teaching students about their educational technology knowledge and skills, and (2) evaluating their current teaching readiness against the backdrop of the new Alberta Education technology learner objectives. Since we found no standardized survey instrument that would meet our needs, we distilled the required learning outcomes of the Alberta curriculum for grades 3 through 9 into a competency set, and then used this

competency set as the foundation upon which to construct a 66-item survey. The Needs Assessment Survey was organized into three subscales:

(a) Demographic (7 items).
(b) Prior computer experience (8 items).
(c) Alberta Education learner outcomes (51 items).

Demographic information was gathered for age, gender, faculty/department of previous degree, highest degree held, home access to computer, home access to Internet, and MT Program specialization. Items pertaining to prior computer experience were measured on a five point scale that was assumed to gather interval level data (i.e., 0 = None, 1 = A little, 2 = Fair, 3 = Substantial, 4 = Extensive). The eight items in this set sought information about degree of prior experience with word processing, electronic mail, browsing and searching the World Wide Web, accessing library resources using the Web, presentation software, Web page creation and editing, spreadsheets, and database creation. These were based upon core objectives of the compulsory education technology course in the previous program.

The items measuring self-assessment of readiness to teach the Alberta Education learner outcomes gathered ordinal level data using a four-point scale. The four points on this scale were distinguished between knowledge and skill, and between personal knowledge/skill and the ability to teach it: 1 = I cannot do this, 2 = I know about this, 3 = I can do this, 4 = I can teach this to students. The 51 items represent 22.5% of the 226 specific learner outcomes from three sections of the new curriculum: (a) 22 of 96 (23%) from *Foundational Operations, Knowledge and Concepts*, (b) 15 of 53 (28%) from *Processes for Productivity*, and (c) 14 of 77 (18%) from *Communication, Inquiry, Decision Making, Problem Solving* (Alberta Education, 1998). Because there was concern that the survey not be perceived as *long* by the respondents, an effort was made to select learner objectives that represented the overall curriculum but were not redundant with other objectives. The three categories of objectives from which we developed our survey appear in Table 1.

Foundational Operations, Knowledge and Concepts
F1. Students will demonstrate an understanding of the nature of technology.
F2. Students will understand the role of technology as it applies to self-work, and society.
F3. Students will demonstrate a moral and ethical approach to the use of technology.
F4. Students will become discerning consumers of mass media and electronic information.
F5. Students will practice the concepts of ergonomics and safety when using technology
F6. Students will demonstrate a basic understanding of the operating skills required in a variety of technologies.

Processes for Productivity
P1. Students will compose, revise and edit text.
P2. Students will organize and manipulate data.
P3. Students will communicate through multimedia.
P4. Students will integrate various applications.
P5. Students will navigate and create hyperlinked resources.
P6. Students will use communication technology to interact with others.

Communication, Inquiry, Decision Making, Problem Solving
C1. Students will access, use and communicate information from a variety of technologies.
C2. Students will seek alternative viewpoints, using information technologies.
C3. Students will critically assess information accessed through the use of a variety of technologies.
C4. Students will use organizational processes and tools to manage inquiry.
C5. Students will use technology to aid collaboration during inquiry.
C6. Students will use technology to investigate and/or solve problems.
C7. Students will use electronic techniques to construct personal knowledge and meaning.

Table 1: Alberta Education Technology Curriculum Categories and General Learner Outcomes

The survey instrument [On-line:] was developed for administration using the World Wide Web. Following pilot testing and revision, it was administered to all students attending Professional Seminar within a two-week time

period during November 1998. According to a pre-arranged schedule, one of the authors met briefly with students in each Professional Seminar and explained the nature and purpose of the survey. It was explained to students that the data gathered could not be traced back either to them individually or to the professional seminar collectively. Each group of students then went to one of two computer labs in which each computer displayed the survey; they completed the survey, and returned to their seminars. Perhaps somewhat surprisingly, most students left the computer labs thanking the authors for the opportunity to participate. A significant byproduct of conducting the survey proved to be its value in heightening awareness among student teachers, and faculty members, of the nature of the new curriculum.

Results

From a potential pool of 383 first year students currently registered in the MT program, 281 completed the survey data, a response rate of 73.3%. Table 2 presents selected demographic data reported as percentages.

Gender:	Female	73%	Male	27%				
Age:	Under 25	40.2%	Age 25-30	43.4%	Over 30	16.4%		
Computer at home:	Yes	83.6%	No	16.4%				
Internet at home:	Yes	63.3%	No	36.7%				
Highest degree:	Bachelor	86.4%	Bachelor (Hon)	9.9%	Masters	2.4%	Doctor	1%

Specializations:	Elementary	55.5%	Early Childhood	1.7%
	Secondary English	7.4%	Secondary Fine Arts	6.8%
	Secondary Mathematics	1.7%	Secondary Science	11.4%
	Secondary Social Studies	7.2%	Secondary French	1.1%
	Secondary Physical Education	7.2%		

Table 2: Demographic data reported as percentages of respondents

Participants have completed their prior degrees in a wide range of faculties and departments: Agriculture, Arts, Education, Engineering, Environmental Design, Fine Arts, General Studies, Humanities, Kinesiology, Management, Pharmacy, Science, Social Sciences, and Social Work. A descriptive summary of prior computer experience of the respondents is presented in Table 3.

Item	Mean	SD
Word Processing	2.84	0.95
Electronic Mail	2.24	1.19
WWW browsing and searching	2.05	1.15
Accessing Library Resources using the WWW	1.63	1.21
Spreadsheets	1.21	1.09
Database creation	0.60	0.96
Presentation Software	0.57	0.91
WWW page creation and editing	0.35	0.74

Table 3. Means and Standard Deviations of Participants' Prior Computer Experience

Overall, participants report the most expertise with word processing, electronic mail and WWW browsing and searching. However, a percentage of students also report having "none" or "a little" word processing experience (9.5%), electronic mail experience (25.5%), and WWW browsing and searching experience (33.3%). Skill areas potentially in need of development support (i.e., "none" to "a little" expertise) for a majority of students appear to be accessing library resources using the WWW (48.3%), spreadsheets (64.7%), database creation (82.5%), presentation software (82.5%), and WWW page creation and editing (92.4%).

One of the authors' suspicions embarking on the needs assessment was that the technology profile of students in the new teacher education program was different from that of students in the previous program. A study by Ott (1996) conducted in Fall 1995 gathered data about expertise levels of students in the compulsory technology course at the

beginning of the semester. Table 4 presents a comparison of the present Fall 1998 survey findings (n=281) with results obtained from students in the previous program (n=101). Differences between the two populations are clear. The 1995 sample included a majority of students who were completing their first degree (79.2%), many of whom were in their first or second year of university (54.5%), and two-thirds of whom had access to a computer at home. A larger percentage of MT students have access to a computer at home (83.6%), and have some prior computer experience with word processing, electronic mail, and spreadsheets.

Item	1995	1998
Access to a computer at home	67.3	83.6
Hold a previous degree	20.8	100.
Some Prior computer experience:		
Word Processing	89.0	99
Electronic mail	32.7	89
Spreadsheets	51.5	69

Table 4. Comparative Percentages of Respondents for 1995 and 1998 Surveys

Teaching Readiness

At the time of writing we are still examining the data gathered regarding teaching readiness. Already, however, some interesting trends seem to be emerging that can inform programmatic decision making. There is, for example, a hierarchical relationship among the three categories of learning outcomes specified by Alberta Education: (1) *Foundational Operations, Knowledge and Concepts*, (2) *Processes for Productivity*, and (3) *Communication, Inquiry, Decision Making, Problem Solving*. The content of each category is supportive of, and in some measure prerequisite to, the category that follows. Interestingly, the level of comfort of the respondents decreased with each successive category. Not a single respondent selected *I cannot do this* for one of the 22 items in *Foundational Operations, Knowledge and Concepts*. As a matter of fact, for 12 of the 22 *Foundational* items, over 50% of the respondents indicated that they were capable of teaching students. They appear to judge themselves considerably less ready to teach items found in the *Productivity* category, and least ready to teach items found in the *Communication, Inquiry, Decision Making, Problem Solving* category. Table 5 illustrates this by providing an example in which the progressive relationship among learning outcomes is easily recognizable.

	1	2	3	4
F4. Students will become discerning consumers of mass media and electronic information				
Analyze techniques used by the media to elicit particular responses from an audience.	0	16.3	28.1	55.5
P4. Students will integrate various applications.				
Integrate visual and audio information to create a message targeted for a specific audience.	51.6	29.5	10.3	8.5
C7. Students will use electronic techniques to construct personal knowledge and meaning				
Use a variety of technologies to organize and synthesize information, e.g., construct an electronic portfolio.	64	22.7	7.8	5.3

Table 5: Example of decreasing confidence in ability to teach with increasing sophistication of Alberta Education learning outcomes.

This trend has added significance given that those who are currently developing the assessment framework for the new technology curriculum are concentrating their evaluation efforts on the third category of learner outcomes on the grounds that both Foundations and Productivity "feed into" or support these higher level goals.

Recommendations

In contrast to the previous teacher education program that concentrated on *foundational* technology knowledge and *productivity* skills with computers, it would appear that efforts in the MT program should be concentrated on more sophisticated technical skills and on the integration, communication, decision making, and problem solving aspects of educational technology. Our challenge now is to address these needs within the modus operandi of the new MT program -- mounting additional courses is not an option.

We are currently considering a number of creative and innovative approaches to increasing the critical mass of technology knowledge and skills among our MT students. One approach is to identify ways in which we can integrate the new technology curriculum within the new MT Program framework. Thus, the authors are experimenting with ways to integrate authentic technology requirements in the Professional Seminar. With the goal of creating a collaborative on-line community, students will learn how to publish and exchange the results of their coursework and investigations using individual World Wide Web homepages. In addition to creating a web-based, electronic portfolio of their own work, students will work collaboratively to research, design, and produce web-based investigations for school age students using a constructivist framework. As one of our guides, we will use McKenzie's (1998) approach to the development of *webquest* projects that promote engaged learning, sustained questioning, higher level thinking, problem solving and fresh thought.

A second approach we are considering is a modified STARS (1998) program, originally developed by Wake Forest University, which would create opportunities for students in the MT program who have an interest in specializing in technology. Student Technology Advisors at Wake Forest are skilled with educational technology, receive specialized training, and provide paid professional development and support to faculty members. Our survey revealed that a small group of our students, between 10% to 15% of respondents, are confident in their readiness to teach all of the learner objectives we sampled. Thus, we have a specialized group of students who could offer professional development opportunities for their peers. A modified STARS program has the potential to be mutually beneficial for MT students who want to further develop their specialization, and for MT students who need professional development in technology integration.

A framework we are also considering has been developed for the professional development of inservice teachers to integrate technology across the curriculum (Alberta Education, in press). This framework, which acknowledges the constructivist perspective of the new curriculum, identifiesÊ*maintenance* and *catalytic* roles in institutional support for professional development and acknowledges the generation of personal knowledge as well as skill-building. It may well be that employing a model of professional development would offer a better guide than the customary content-delivery curricular model of higher education. Adopting this framework may be a significant step not only for integrating technology into the Master of Teaching program but also in beginning toÊaddress the discontinuity between preservice and inservice teacher education.

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A University Class in Web Design for Teachers: Content and Rationale

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Abstract: This paper presents an outline and a discussion of the philosophy and rationale for a course taught by the presenter on web design and production for teachers at the University of Nevada, Reno. Aids and cautions for instructors are provided. The problem of the needed changing nature of university computer centers and personnel in an age of web-based teaching will be introduced and discussed by the presenter and the audience.

Introduction

One of the most startling phenomena of this Century has been the rapid pace of development and proliferation of electronic technology. For those of us who enjoy observing technology and its effect on U.S. and world culture, this is surely the most interesting possible time to be alive. Indeed, in the last quarter of this Century, the pace of technological change has been so rapid, and we have become so accustomed to it, that we have almost ceased to notice each new development, which seems to proceed from innovation to cultural artifact in the space of a long breath.

The Rapid Pace of Technological Change

One of my students in a recent class mentioned that she had seen a list of innovations that we take for granted today, but that did not exist as recently as 1972. She mentioned *Magnetic Resonance Imaging, video cassette recorders*, *FAX machines*, and *bar codes*. To this list, the class added *pagers, CAT Scans, digital television, cellular telephones, the Global Positioning System, cordless telephones, laser surgery, automatic teller machines, compact disks, space stations, walkmen, digital cameras, surround sound,* and *large screen TVs*.

As remarkable as this list is, it would be incomplete without the addition of *personal computers*, the *Internet*, and the *World Wide Web*. In fact, computers and modern telecommunications probably hold more potential for transforming worldwide cultures than the rest of the innovations mentioned above put together.

Computers, Schools, and Cultural Momentum

At one time in the not-too-distant past, many of us feared that computing in education would not succeed, and that computers were in danger of being abandoned by teachers. That fear proved groundless, as computers became so firmly entrenched in every walk of life that I often think we could probably not now stop their continued entrance into schools even if we tried to do so. Computers have become ubiquitous. We see them everywhere we go, from the smallest to the largest businesses and governmental agencies, in libraries, restaurants, theatres, airports, and, increasingly, in schools. Computers have gained so much cultural momentum that they will continue to proliferate in schools and elsewhere.

Growth of the Internet and the World Wide Web

The growth of the Internet has been so rapid, and is so unprecedented that no one is really sure exactly how large it is at any given time, and estimates are out of date almost before they are published. Most estimates at the end of 1998 suggest that there are now at least 40 million Internet hosts, many of which

represent hundreds or thousands of individual users. There are probably more than 80 million users in the United States alone, a figure that has grown by amost 30 million in the last nine months of the year. In fact, it appears that at least 11,000 new people go online each day. U.S. households with an Internet connection now number 20 million (42% of all households), and the fastest growth in achieving connectivity is among lower socioeconomic households. Projections are that by the year 2000, there will be at least 101 million hosts and the Internet will have grown by more than 2000% since its inception.

Figures on World Wide Web growth are even more impressive. Although the Web did not become available until 1993 when the Mosaic browser made its debut, the Web has grown to include at least 275 million pages and is increasing at a rate of about 20 million new pages per month. At least 1600 new businesses a day establish a web site and web sales have grown from $200 million in 1997 to at least $4 billion at the end of 1998.

The Internet, the Web, and the Transformation of Culture

With such amazing growth, it is obvious that the Internet and the Web is having, and will continue to have profound effects on worldwide culture. In the space of little more than five years, the ability to publish information has shifted from huge publishing houses, giant corporations, and governmental agencies to individual citizens anywhere in the world. If information is power (and I believe it is), this must represent *the most complete, rapid, and profound power shift in the history of the world!*

What the ultimate effect of this shift in the balance of power will be is anyone's guess. Already we see traditional publishing houses diversifying frantically and governmental agencies scrambling to regulate this new and, to many, frightening new medium. Even universities, which we like to regard as bastions of expressive freedom, are scrambling to regulate what students and faculty may and may not publish on the Internet and the Web. Indeed, the urge to *control* seems foremost in the minds of many of the traditional power brokers. It will be interesting to see if they are successful in curbing the individual's power to communicate with the new information tools. I suspect that any such successes will be localized, temporary, and trivial, as all such moves to curb the free and open exchange of information have been in the past. With regard to information and communication, history teaches us that *limits will be imposed only by the power of the technology, rather than by the power of government, regulation, and law*.

The Internet, the Web, and Teacher Education

It should not be surprising that the recent unprecedented growth of the World Wide Web has brought about a number of changes in universities. Among these changes has been:

1. the trend for professors to begin to use web pages as informational and/or instructional supplements to their courses, and
2. the trend for colleges of education to offer courses in web design for teachers.

A third development, and one which university administrators would do well to consider, is the rapidly growing trend for universities to offer traditional credit or even partial or complete university degrees for completion of coursework offered *totally* on the Web.

Although web-based courses and degrees have even more potential for transforming (some would say *destroying*) traditional university culture than do the other two trends, complete off-campus courses and degrees will not be discussed in this paper. The topic is deserving of a treatment all its own, and calls for an institutional, rather than a professorial response.

Suffice it to say at this time that I believe far too many universities, especially many of the venerable, research-based institutions in our country, seem to be "burying their heads in the sand" with regard to this issue. *Web based courses and degrees are not going to go away.* Indeed, they are continuing to grow spectacularly, and reacting to them by labeling them derisively as credit or degree mills will not prevent students from enrolling in them, any more than such labeling has prevented increasing numbers of students from availing themselves of other nontraditional, highly commercial, off-campus programs, many of which almost all of us agree are inferior.

Complete, web-based courses and degrees must be taken seriously by university administrators, and a reasoned institutional response formulated. Academic integrity should be a major consideration in all planning, but refusing to consider any alternative to traditional on-campus courses and programs may amount to administrative "fiddling while Rome burns."

Web Pages as Supplements to Traditional Instruction

Offering complete off-campus credit courses and programs are not within the authority of individual professors. However, most of us enjoy the freedom to institute web pages to supplement our traditionally offered classes. Such web supplements have many advantages. I have maintained such pages for all of my classes for the last two years, and have found the following components to be desirable:

1. Complete identification, including university, department, college, course name, course number, catalog description, abbreviation, semester and year, and name of instructor
2. One-paragraph statement of the purpose of the page.
3. Role of the course in the overall program.
4. Telephone number and office hours of the instructor and hot link to instructor's e-mail address
5. A "date last modified" line (I use a simple javascript program to keep this current automatically - details to come).
6. A "hit counter" to keep track of the number of times the page is viewed
7. Textbooks required and/or recommended
8. Course objectives in behavioral terms, when possible
9. Course requirements with full descriptions
10. Grading criteria
11. Links to recommended sites related to course content
12. Course calendar including due dates for all assignments and dates for all quizzes and tests
13. Links to my other web pages for other classes
14. Links to university page and to college and/or departmental pages
15. Credits for any graphics used on the page
16. Standard university footer including university name and logo, URL of the page, another "date last modified" line, and e-mail link to instructor.

As the semester goes by, I add links to each handout and a marquee or javascript alert at the top of the page for announcements. Examples of two such pages can be seen at:

1. *http://unr.edu/homepage/maddux/prog/sylcp411.html*
2. *http://unr.edu/homepage/maddux/stat/cep740/cep740s2.html*

The contents proposed above constitute a practical level at which to begin implementing web supplemental pages. Students indicate that they appreciate this service, and one of the great advantages is that it renders unnecessary most of the time-consuming searches of paper files to find handouts, syllabi, and other materials that students have lost or were absent when they were distributed. Since everything is on the web, instructors can simply advise such students to go to the class web page and download whatever is needed.

As time went by, however, and I discussed these class web pages with students, I realized that what many wanted represented a second level of complexity. Time and again, students expressed appreciation for the web pages, but emphasized that what they really needed were *lecture notes*, and *tutorials*. Consequently, I began adding them to the beginning and advanced statistics courses I teach. Two examples can be found at:

1. *http://unr.edu/homepage/maddux/stat/statpage.html#cep640*
2. *http://unr.edu/homepage/maddux/stat/cep741/cep741s1.html*

Although the addition of lecture notes and step-by-step tutorials have added considerably to the instructional workload for these courses, the initial investment of time and effort have proven well worthwhile in the long term. I no longer have to deal with students who were absent and who want a private repeat of the class.

More importantly, I have found student performance has increased considerably, since students can listen intently in class, then review the lecture notes at their leisure as many times as needed. Test scores have gone up dramatically. The addition of the tutorials have the same advantages. In addition to saving the cost of photocopies, students can watch as I do in-class demonstrations rather than scramble to take cumbersome and often inaccurate notes, then they can review the tutorials later, repeatedly if need be.

The major disadvantage of adding the lecture notes is the time it takes to convert them to HTML files. However, considerable speed can be developed at this over time. I usually return to my office and put up the day's lecture notes immediately after class, and it seldom takes me more than 45 minutes to do so for a class that meets for three hours once each week. Although I write the HTML directly, many instructors find an HTML editor such as *FrontPage 98* to be a better alternative. An unexpected advantage to converting my lecture notes for the Web is that it encourages me to write more complete and more up-to-date notes.

A Course in Web Design for Teachers

Many colleges of education with programs in information technology in education have begun to offer courses in web design for teachers. This is understandable in light of the current move to establish or increase Internet and Web connectivity in public schools. Naturally enough, such courses are especially appropriate for web page supplementary material.

One of the major decisions with such a course is whether to teach students to code directly in HTML (hypertext markup language) or whether to allow the use of a commercial HTML editor such as *MicroSoft's FrontPage 98*, or one of the many freeware or shareware programs that can be downloaded from the Web.

I believe that both approaches are necessary. Unfortunately, there is no such thing as a true *what-you-see-is-what-you-get* editor, and it is almost always necessary to "tweak" the code produced by any of the existing editors. To do so effectively and easily, one must master at least the rudiments of HTML. Then too, exclusive use of an editor ties students to PCs which have an installed editor, while the ability to write HTML can be practiced on any PC anywhere in the world, regardless of installed software.

Therefore, in our web design course, we begin with HTML, then slowly introduce editors and a variety of excellent web pages such as *TableMaker* (http://www.bagism.com/tablemaker/), *ColorMaker* (http://www.bagism.com/colormaker/), and *FrameShop* (http://www.bagism.com/frameshop/) which will produce customized HTML on the spot.

For this course, the concept of *lectures* make little sense. Therefore, I have put together a web page that demonstrates each of the concepts dealt with in the course. Each night, we cover several topics. The students can review these topics ahead of time or after class, and they can view the HTML source from the demonstration page as we go through it. The web page for the course is at: *http://unr.edu/homepage/maddux/prog/sylcp411.html.* There is a link to the demonstration page on the above page. The URL for the demonstration page is *http://unr.edu/homepage/maddux/prog/demohtml.html.* The demonstration page illustrates the concepts in the order specified below:

1. *Formatting Text*
2. *Links*
3. *Meta Tags*
4. *More Text Formatting*
5. *Graphics*
6. *Alignment*
7. *Definitions and Lists*
8. *Using Color*
9. *Displaying Special Characters*
10. *HTML Tables*
11. *Controlling the Size of Tables*
12. *Tables and Color*
13. *HTML Validators and Checkers*
14. *Counters*
15. *Guestbooks*
16. *Free Submission Services*
17. *Free cgi-Scripting on Remote Servers*
18. *JavaScript*
19. *Forms*
20. *Image Maps*

One of the challenges in a course in which HTML plays a major role, is keeping a focus on educational design issues. Throughout the entire course, the emphasis should be on writing pages which are of educational benefit to students and teachers.

In keeping with this goal, there are links on the main course page to the following sites that I have found to be of benefit in keeping an instructional orientation. I have listed only those sites that have proven to be available over a long period time:

1. *Best High School Web Site - http://www.baseball-news.com/highschool/besthswebsites.htm*
2. *Best School Web Sites - http://www.rdg.ac.uk/~veskeinr/scwebsit.htm*
3. *Blue Web'n Site Evaluation Form - http://www.kn.pacbell.com/wired/bluewebn/rubric.html*
4. *Web Resources for Teachers - http://www.cableducation.ca/cic/connecting.html*
5. *Developing a School Home Page - http://www.siec.k12.in.us/~west/online/noncoll1.htm*
6. *Designing School Web Sites - http://fromnowon.org/webdesign.html*
7. *A Guide for K-12 Schools Wishing to Get on the Internet - http://www.cvu.cssd.k12.vt.us/k12tech/k12tech.htm*
8. *Guidelines and Suggestions for School Web Sites - http://www.madison.k12.wi.us/hpguides.htm*
9. *High School Web Sites - http://news.vpsa.asu.edu/search/hsnews.html*
10. *High School Web Sites: Tips - http://7-12educators.miningco.com/msub7.htm*
11. *Infoseek's School Web Sites - http://seek-p.infoseek.com/Topic/Kids_and_Family/Education/Internet/School_web_sites*
12. *Kathy Schrock's List of Links to Web Evaluation Instruments - http://www.capecod.net/schrockguide/eval.htm*
13. *K-12 School Webpage Policies and Guidelines - http://206.76.136.3/resources/webguid.html*
14. *NPDL: Evaluating Educational Web Sites - http://oii.org/archives/evaluate.html*
15. *Resources for Educational Website Development - http://www.ilt.columbia.edu/k12/livetext-nf/wwwdev.html*
16. *School Cyberlibraries - http://www.infotoday.com/MMSchools/nov97/voic1197.htm*
17. *School Web Page Development Guide - http://www.massnetworks.org/~nicoley/schools/*
18. *School Web Sites of the Year - http://www.vste.org/sigs/sigtel/website.html*
19. *Selected Elementary School Web Sites Featuring Student Work - http://www.microstore.com/ardis/schoolsites.html*
20. *Site Evaluation Form - http://www2.open.k12.or.us/jitt/evalform.html*
21. *Tracy Marks' Best K-12 Schools Bookmarks - http://www.geocities.com/~webwinds/k12/schools.htm*
22. *The Web as a Research Tool: Evaluation Techniques - http://www.science.widener.edu/~withers/evalout.htm*
23. *Web Style Resources: Best and Worst of the web - http://www.devry-phx.edu/webresrc/webmstry/stylbest.htm*
24. *WWW CyberGuide Ratings for Web Site Design - http://www.cyberbee.com/guide2.html*
25. *WWW Style - http://www.hypernews.org/HyperNews/get/www/style.html*
26. *What Makes a Good Webpage? - http://www.crpc.rice.edu/CRPC/Women/GirlTECH/Materials/rubric.html*

From Centralized Computing to Distributed Computing and Back Again

One of the major problems with making use of the Web for educational purposes of any kind is the loss of control over the teaching and learning resources experienced by individual instructors who embrace this new technology. The more instructors begin to rely on the Internet and Web in their instruction, the more catastrophic to teaching and learning it becomes when hardware or software problems make telecommunications unavailable.

It is ironic that the educational computing movement began with reliance on centralized computing for a host of schemes involving old-fashioned programmed instruction. As personal computers became available, we moved quickly away from centralized computing and toward distributed, desktop computing.

However, the Internet and the Web have changed all that. In universities and in public schools, instructors are relying more each day on centralized services to provide them with Internet connectivity and mainframe software such as statistical packages, mail readers, etc. *Unfortunately, most university and*

school district system computing specialists are not ready for this return to a reliance on centralized computing.

What many IT specialists lack is not technical expertise, but the belief in the importance of, and skill in assisting non-technical specialists. They also need the realization that instructors who rely on central computing for connectivity while conducting a class, cannot be expected to defer requests for help days into the future. If a lesson requires students to use E-mail, instructors panic and reach out for immediate assistance when the mail server goes down just before class convenes, or when they discover that their students' E-mail accounts have been deactivated with no advance warning. There is no longer room in system computing for technicians who dislike dealing with people, who refuse to return telephone calls, or who make sweeping changes in widely-used hardware and software without notifying all instructors who depend on these services.

Because of such problems, many university departments have elected, out of desperation, to establish their own web servers and mail servers, and provide other specialized hardware and software at the departmental level. In many cases, this kind of duplication of hardware and software is not cost-effective or otherwise efficient, and is done only because the central computing system has proven unresponsive to the instructional needs of non-technical faculty and staff.

I believe unresponsiveness of computing system technical staff to the time sensitive instructional needs of faculty is one of the major roadblocks to wide web usage in courses in typical American universities. I am unsure how best to begin to address this problem. I am reluctant to propose additional meetings, but it does seem to me that instructors and IT professionals employed by central computing services need to talk more. Those hiring IT professionals need to make the ability to assist non-technical faculty an important requirement for employment, and such ability needs to be encouraged and rewarded among existing IT staff.

Conclusions

The Internet and the World Wide Web have only just begun to transform worldwide culture. Education typically lags behind the rest of culture in terms of the pace of change. However, the Internet and the Web are so pervasive, and have attained so much cultural momentum, that this technology has already begun to bring about profound changes in education. Cultural change is never altogether comfortable for everyone, and always causes a number of problems. With all its current problems, however, I believe that we are privileged to be alive and to be educators during such exciting times. I believe the Internet and the Web represent the first and only technology with the potential to revolutionize teaching and learning. Perhaps we will finally realize our long-standing and unrealized dream of individualization of instruction. And I believe we can and will solve most of the problems we are currently experiencing as we begin to bring the Internet into classrooms. Information technology in education has withstood the first wave of challenges, and computers are in classrooms to stay. What we do in the next few years will determine whether or not the new technologies are as beneficial to education as they promise to be in most other walks of life.

Integrating Technology: Multimedida Portfolios In Education

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As efforts directed at reforming education continue to dominate the national spotlight (McKay, 1998; Richards, 1998), recent discussion has asserted that inclusion of technology provides a positive impact on educational classroom settings. Some (Guernsey, 1998; Fulton, 1996) suggest that integration of technological tools into public and private school settings will revolutionize education. Technology, the "new sacred cow" (Cordes, 1998), has been viewed as the panacea for many of the ills facing elementary, secondary, and advanced educational settings.

However, legitimate questions regarding the efficacy of such a reliance on technology have been presented (Cordes, 1998). Many, including those with a more traditional view, question the financial resources required for a technology infrastructure as well as the instructional time required while facilitators and students become skillful in the use of newly acquired hardware and software. Further, they question whether students actually witness increased learning or are merely developing techniques to attractively package less than exemplary products.

The purpose of this paper is to advocate the introduction of Multimedia Portfolios in educational settings while identifying the benefits and cautions related to such a decision.

Trends in Educational Reform

The first major benchmark in the current generation of education reform appeared in 1983 with the publication of "A Nation at Risk" (1983). However, related to the trends of recent technology reform efforts, many stakeholders are questioning how technology fits into the scheme of revolutionizing education. Some (McKay, 1998; Richards, 1998; Guernsey, 1998) suggest that as a result of technology reform efforts, professional pressures on teachers have decreased and the efficiency of student comprehension has increased.

Related to actual instruction, computers are an invaluable tool for providing active collaborative learning and assessment. More sophisticated interactive multimedia packages offer true inquiry-based learning, where students must construct knowledge (Manges & Wigle, 1997) and demonstrate solutions to a variety of in-class projects. The computer must be recognized as an effective teaching tool, which assists the educator, and prepares students for the marketplace demands with which they will be confronted.

Student Portfolios

One of the key problems facing education reform is that traditional teaching fails because students have no use or interest in much of the material as it is presented (Wigle & Manges, 1995; Glasser, 1990), yet in order to expand their understanding of a given subject, they must become involved in the entire teaching/learning process.

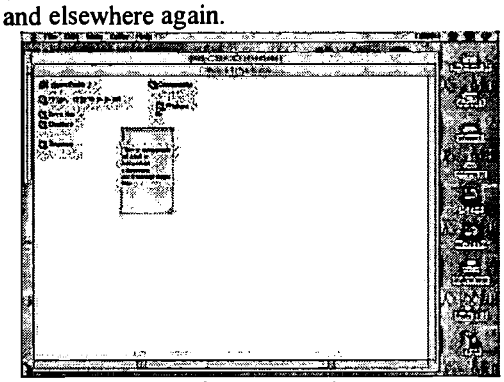
One strategy which is effective in accomplishing these goals is a focus on the use of student portfolios. Many educators have experienced and research (Richards, 1998) has established the numerous educational benefits that portfolios offer students and instructors. Traditionally, students are challenged to compile classroom materials that they have produced. These items usually become the students' portfolios, which are examined as a collection exhibiting individual and group growth, understanding of the course materials, and oftentimes an understanding of themselves as students and future educators. Physically, the instructor must deal with boxes of heavy, fully loaded, multicolored 3 ring binders that often represent significant amounts of paper. Most often, the portfolios are never

picked-up by students. The result is an office cluttered with tenuously loaded binders, ready to spill their contents at any moment.

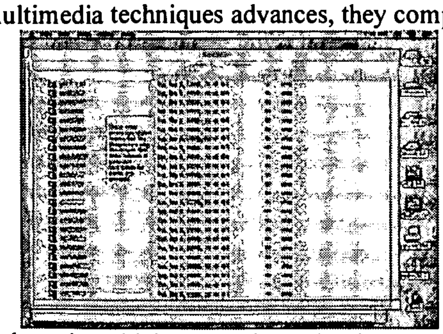
Multimedia Portfolios

Over the past few years, the concept of multimedia portfolios has been seen as a viable alternative to traditional forms of student collections. Like the portfolio discussed above, they represent a collection of students' work over a semester. However, they are different for many reasons.

1. Students are able to establish a personalized table of contents that creates a feel of nonlinearity, allowing them to establish an interconnected portfolio in which the reader can move from a student's rough draft, to a final draft, to the table of contents, and elsewhere again.



2. In addition, many teachers encourage revision of student projects, often awarding extra credit for such efforts or by having revision a built in component for each project. This, of course, works the same way with multimedia portfolios. One difference is that with multimedia portfolios, students initiate revision as well, even though it is not required nor is extra credit provided. Students see their portfolios as "theirs" to design, modify and change. As student sophistication with multimedia techniques advances, they completely redesign their portfolios.



3. Furthermore, unlike 3 ring binders, in which the only technology students use are computer printouts or

photocopies of materials, multimedia portfolios are natural to the technologies that schools have available.

4. When students have on-line access with a networked server, they can create individual student folders and files where they can keep their portfolios. This means that they do not have to lug around a binder. However, unlike 3 ring binder portfolios, which allow students to complete work at home or elsewhere, using multimedia portfolios typically demands that students must work in computer labs to have access to the technology, unless they have their own "high-end" machine at home.
5. Another possibility, frequently used in connection with the on-line folders mentioned above, is the use of ZIP disks. Zip disks are useful because computers create a fragile environment prone to crashing and freezing, resulting in lost materials. Also, ZIP disks are portable being about as large as a standard 3.5 diskette and about twice as thick.

The multimedia portfolio allows students to include their pictures and drawings, but it also lets them make these pictures interactive and professionally incorporated into the overall theme of the portfolio. They integrate music and other sounds appropriate to their research. Moreover, they incorporate quicktime movies that they produce.

Cautions

The barriers experienced are few, but oftentimes alarming. First and foremost, faculty support must be on-time, on-target, and on-going. Many institutions work on various servers, and for security reasons, faculty access may be denied. If voice messages go unheeded or are returned days later, frustration and discontent are experienced.

Conclusion

When students are provided opportunities to investigate their areas of interest and to create their own media for expression, they are much more willing to invest increased amounts of time in this endeavor. When students have power and control over the ways they communicate, appealing to multiple senses simultaneously, they have raised the standard of quality. When students are provided opportunities to effectively use technology, they are focused on sending a message that a broader audience will inspect and respect.

Engaging students from a variety of angles and allowing them to feel as if they are a part of the subject matter will often lead to them becoming more interested in (or at least more willing to discuss) that subject. Students, when encouraged and given the proper opportunity and medium, can express a wealth of opinions on nearly any subject. And, by giving them the chance to articulate and share their thoughts, they can grasp the meaning of the subject and understand it better.

Students of all ages learn better when they are actively engaged in a process, whether that process comes in the form of a sophisticated multimedia package or a low-tech classroom debate on current events. Over the years, social scientists and education researchers have attempted to question the traditional notion of the passive classroom environment. In order for today's young people to become competitive in tomorrow's marketplace, yesterday's pedagogical methodology is no longer enough. We must now begin to teach and accept that as students use and become competent with 20th century technologies, their ways of composing and articulating should be different than most of us experienced. Multimedia Portfolios provide students and instructors with new ways of collecting and measuring students' accomplishments.

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Lessons Learned from the Trenches: Implementing Technology in Public Schools

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Abstract: Computer and communication technologies afford unique opportunities for teaching and learning. As a result, these technologies have become common, if not pervasive, in the modern classroom. Unfortunately, simply providing schools and teachers with technology is not enough to ensure appropriate and effective use. This paper describes issued encountered in a series of large-scale implementations of instructional technology in public schools and vocational centers across the nation.

Introduction

Your classroom is equipped with new computers. They are loaded with the latest and greatest software titles. Your building is wired for the Internet. This paper discusses the practical issues of choosing and using educational software in the classroom.

Computer and communications technologies provide teachers with a myriad of tools for connecting and educating their students. As a result, these technologies have become common in the modern classroom. In 1983, schools had one computer for every 125 students. In 1995, schools had one computer for every 9 students.(Glennan & Melmed, 1996). Simply putting computers in schools, however, does not ensure the effective use of technology. Not surprisingly, several common mistakes are made when "wiring" the schools of tomorrow. This paper seeks to inform teachers and administrators about the practical issues involved in choosing and using technologies in the classroom from the experience of eight years of the Fundamental Skills Training (FST) project.

Background

Since 1990, the Air Force Research Lab and the University of Texas at San Antonio, have been engaged in a long-term research project to bring state-of-the-art intelligent tutoring technology to bear on our nation's growing literacy skills problem in areas such as mathematics, writing and science. The primary goals of the FST project are to design, develop, evaluate and transfer prototype intelligent tutoring systems (ITS) to public schools, and, when appropriate, to industry under federal technology transfer guidelines.

Three tutors, the Word Problem Solving Tutor (WPS), MAESTRO, the Writing Tutor, and the science tutor, Instruction in Scientific Inquiry Skills (ISIS) were developed. These three tutoring systems have been evaluated in field studies involving 40 public schools and several vocational centers across the nation. These studies, involving 40-50 teachers and as many as 3,000 students each year, have evaluated the effectiveness of the software in enhancing critical thinking skills. In addition to the 18 studies conducted, a host of information has been gathered concerning integrating technology into traditional classrooms.

Planning for Technology

Instructional technologies, both hardware and software, cannot be simply purchased and dropped into schools for immediate deployment. Rather, administrators and teachers must carefully plan for the implementation of technology.

Selecting Technologies

Decision-makers must address a few key questions before purchasing educational software. For example, how well does the software address student and teacher needs? What does the software do (i.e., is it a tutor in a box, a cognitive tool, or a vehicle for student-teacher communication and collaboration)?

Barbara Means (1994) classifies the use of educational technologies into four broad uses: tools, communication, tutors, and exploration. The most simplistic of these categories are educational technologies that are used only as tools. A prime example of this would be a word processor. In this sense the tool is only a mechanism to assist a student in completing work. Educational technologies that are used for communication include programs that allow teachers and students to transmit information to each other via a network. Technology used as tutors include programs that teach users information and may include demonstrations, real-time analysis or simulations. Technology used to explore would guide the student through information allowing the student to learn facts, concepts, procedures, and strategies, as he/she interacts with the system (Means, 1994).

The extent of the software uses should govern the decision of choosing the software to be used for instruction. In addition, other variables may also need to be observed (i.e. What other departments could use this software? Do other departments have the software?).

When evaluating software an important aspect to consider is the role of the software, e.g. Is it to be used as a part of the core curriculum or as an enhancement? Does the software serve a dual purpose, does it incorporate tools into the tutor or exploration educational technology? Dual functionality is an important aspect in the design of any software but evaluators must decide if there are other software packages that present the information more efficiently. If so, the evaluators should choose the software that presents the most exemplary material and then look to over abundance of word processors that exist to fill the void. Remember, the purpose of educational technology is to improve a student's performance, not to provide state of the art software.

Cost of Implementation of Curriculum

More important and more of a burden than the financial costs are the curricular "costs" associated with technology. Teachers must decide what topics they must cut from their normal classroom curriculum in order to allocate time to using the software. In some cases, the choice to integrate "learning technologies" or educational software to teach specific topics or sub-topics is easy. In other cases it can be much more difficult. Unfortunately, many programs are seldom a good match to a particular classroom's core curriculum and hence, tend to be regarded only as "enrichment" (Means, 1994). As a result, many technologies that assist students in learning have a tendency to have a limited impact on students' core educational experiences. Instructors must not only decide how much of a role technology will play in their curriculum but also the impact of the programs. However, eliminating 15-20 hours of in-class time over an academic year requires the teachers to seriously reconsider their curricular choices. These choices are not easy given the pervasive emphasis on state testing requirements but the teacher must decide whether or not

the lessons taught by the software are important enough to warrant a significant amount of their class time or if the program will only be used as an "enrichment."

Preparing Teachers

Research has found that the inability of teachers to effectively use software is, in part, due to the lack of resources supporting their use of it. Becker, (1994b) using a survey instrument, found low levels of computer use and low levels of effective use. Specifically, teachers were only using computers for drill and practice and avoiding more complicated applications. Further, Becker notes that schools which offer high levels of teacher development on computers and provide technological coordinators to provide technological support are more likely to have teachers using computers effectively.

Another important question is concerned with how teachers will accept technology. If their perception is negative but they have an open mind, time should be spent educating them on the benefits of technology. Some teachers may feel apprehensive or may experience fear when using computers. Rosen and Weil (1995) found that the principal reason instructors were afraid of technology was due to a deficiency of experience using computers. Researchers have documented the critical role of professional development in improving teachers' ability to carry out new approaches to instruction (Collins, 1992; Duffy, 1992; El-Dinary & Marks, 1992). Thus, the need for training is evident, teachers must be trained and supported before they will feel ready to effectively use the software.

Generally, a good rule of thumb to follow when it comes to operation of powerful and dangerous equipment is that time should be spent training the potential user. Technology is no different. Time and effort must be carefully spent to ensure that the user can not only confidently use the software but that he/she has developed an in-depth understanding of it and can use it as a tool to teach students.

Teacher Training

When implementing technology, the importance of teacher training as a key component cannot be emphasized enough. Simply, it is required for successful implementation of any type of technology. Many teachers do not have experience using computers to deliver instruction to students. Instead, they use computers for recording grades and to develop paper-based handouts and exams. Teachers need not only understand instructional software from a user's point of view, but also how to teach with it. The teacher's role in the classroom is not to put hands on the keyboard or mouse, but to stand next to the students acting as a partner in the instructional process. Due to this importance, teachers should receive the time needed to attend training and to become effective with the software.

Integrating Technology

Perhaps many teachers view using technology as a simplistic tool to assist students with their lessons (e.g. a typewriter) instead of utilizing software to explore, to communicate, or to teach students by providing information, demonstrations, or simulations. As a result assignments may result in computer use, but these activities are less than effective. As a preventative measure, instructors should ask several questions before looking to insert technology into their classrooms (i.e. Is this subject appropriate for technology? What kind of software exists to support the students' work in extended, authentic learning activities? Does this software provide examples and tools to further the students' work?).

While technology exists in many different forms, it should never be used when it is not appropriate. There are many tasks that exist that could be taught using technology, but it should not be viewed as always being applicable for teaching. Teachers should choose to use technology based on case by case objectives. For example, the use of technology in a History class can be effectively used as software can furnish hyperlinks to provide students with information. Other domains, such as Math and Science, are ripe for teaching domain knowledge using Computer Based Instruction (CBI) and simulations. Conversely, English is a subject that is more difficult to teach using technology. Natural language processing is an area that has proved difficult to master.

When a teacher or administrator views the domain as appropriate for technology he/she must next investigate what types of software are available to assist them in teaching the subject and then evaluate the software. Decisions must also be made concerning how the technology will be inserted into the curriculum (i.e. Will computer use result in a change of teaching style? Is this software appropriate for this population? How will computer use be graded? How much time will be spent on the computer? How will the students be introduced to the computers? What new materials will need to be created?).

Implementing Technology in the Classroom

Educational Setting

In addition to the common hardware implementation issues (e.g., technical specifications of the computers, connecting to a network,) there are a multitude of issues that must be addressed before students are allowed to use technology. The number and arrangement of computers in an educational setting is a critical issue facing the school districts. One arrangement is to have 25-30 computers networked in one room. This arrangement provides opportunities for equal access to the technology for all students. Depending on the software, teachers most likely are able to individualized the instruction to the needs of the students. In addition, if students are working in a computer lab, the physical setup will be of great importance as the layout of the room can directly influence the work of the students. For instance, if a classroom is set up in a U-shape students can view the status of their neighbor which can lead to many interesting research topics concerning competition.

An alternative arrangement that is growing in popularity is to have 6-7 computers in the back of the regular classroom. Proponents state that this arrangement will provide teachers more opportunities to individualize the curriculum. On the other hand, some teachers in our project have expressed concern that the computers in the classroom arrangement will cause classroom management problems. They are concerned that teachers will not be able to provide equal access to the technology. If access is based on student-choice, students who are less computer literate or hold negative attitudes towards computers may benefit as much as computer enthusiasts. If access is teacher-driven, administering access time and curriculum covered may burden the teachers with additional administrative workload. Another issue is the amount of time the computers would be used. In our lab-based arrangement, computers are used almost constantly. Skeptics of the classroom-based arrangement, fear that the computers in the classroom will not be used as frequently by the students lowering the total access time to the available technology.

Software

Examining software further there are various questions about software variance teachers should be aware of when preparing to implement (i.e., Can the software be installed to a network or does it only run on stand-alone machines?). Teachers should also ask whether or not the software has tools that set the curriculum and if these tools may be placed on additional machines besides the server on a network?

Accompanying the questions of where the software is installed should be issues concerning the security of servers, teacher machines, and client machines. Teachers should address where the server will be kept and what access they will have to it during the day. Also, if teacher machines are available what restrictions and where will they be located should be noted.

The topic of software and printers is another important issue. Teachers should know the software and be able to estimate the amount of paper which could be used and determine what is most important and should be included in the portfolio assessment. The use of printers, toner cartridges, and paper can become a costly issue if not addressed apriori.

As more and more computers are wired for the internet new issues beyond the protection of computers for software viruses will become evident. Students having access to the internet must realize that they are accountable for the information they will be downloading. Many protective software packages are available to restrict student exploration, but even these have their limits. Issues might arise when the student is using the computer to do research and is searching for information on key words such as "breast" and "cancer". While many sites may have important and valued information concerning this topic, at this time search results may return sites that are inappropriate. Software which would prevent access to these

sites would also prevent access to health related sites as well because sites concerning questionable information would be blocked.

Teachers will also have to ensure that students are accountable for information that is relevant and that students stay focused on the task at hand and not engage in viewing the latest information from a sports web site, playing a game, or sending e-mail.

Technological Personnel Support

An important factor in making implementation less intimidating is the school providing technological personnel support. These positions would serve to support teachers in the day to day maintenance of technology, communication, troubleshooting, and repair problems as they occur. Teachers may excel in understanding and using software to instruct students, but may not possess the knowledge or the experience to troubleshoot hard drive failure or install and run a file to update a version of the software.

Schools may provide this support in the form of a Site Coordinator (SC). This position is usually filled by a teacher within the school and functions as a liaison between administration, teachers, students and vendors and helps with such duties as: facilitating testing, coordinating research activities, facilitating communication, scheduling site visits, conforming with district policy, and handling paper work (e.g., reporting hardware and software problems).

Additionally, if funding allows, schools should hire a lab technician to manage the local area network, software, and computer hardware. This person should monitor classes coming into the lab and troubleshoot problems which may arise. A lab technician is usually a person with some computer experience, if not a computer programmer. This makes an ideal candidate to communicate with the vendor's technical support team. This type of experience can be very valuable and may help to avoid implementation issues before they originate.

Lastly, the technological support personnel can investigate issues which may affect the implementation before the software is purchased. For instance, will the software work on both Windows 3.1 and Windows 95? Where is the company headed? How does the company handle upgrades? When is the next upgrade of software due to be released? If software is purchased are upgrades free for a certain time? Is there a reduction in price? What is the price difference between a Site license and buying 35 copies for the lab? Has the company worked with education in the past? What issues did they face?

Teacher, Administrator and Vendor/Research Project Responsibilities

In order for technology to be successfully implemented and used effectively teachers, administrators, and the vendors/research projects must fulfill their responsibilities. Teachers ultimately control the curriculum and the use of the software as applied to the curriculum. They communicate with their Site Coordinator or the vendor concerning any problems which may occur with software, hardware, and students. Teachers also assist the SC in scheduling of calendar, dates, pretesting, site visits, entering student rosters, completing paper work (i.e., proprietary information), and possibly training new teachers. Teachers may also have to inform the administration of new technologies that exist and how significant it is that they are given an opportunity to teach using these tools and the importance that students are given a chance to learn using technology. It is also the responsibility of the teacher to discuss what goals the administration is trying to accomplish by installing new technology and how will they be asked to demonstrate the effectiveness of the software.. Teachers may also have to inform the administration what criteria is appropriate to judge the effectiveness of software besides cost effectiveness and increases in standardized scores.

It is the responsibility of the administration to assist in finding and evaluating new software, and researching the software for potential use in the schools. The most important responsibility of the administration is to ensure teachers have time off for training, have time to learn the new software, and entrust technology to teachers that are accepting of technology. Lastly, it is the administrators obligation to know where to look for funding new technology, how to apply for these funds and to involve teachers by sharing this information with them.

Perhaps the most overlooked responsibility in ensuring the success of technology is that of the vendor or the research project. Quiet simply it is their burden to demonstrate that their product effectively

teaches students. Vendors/Research projects should be able to present results and provide information about other groups who have used their products. Furthermore, vendors/research projects must provide users with materials and documentation guaranteeing that the information concerning underlying philosophies, project background, software and hardware requirements, communication, user rights, general help and instructions are available for reference.

Research groups have additional responsibilities beyond vendors. For example, they must write the software so that no segment of their population is left unable to use it. Technical support to ensure continuity of the project must also be carefully maintained. The research project must also report and publish results in a timely fashion and present results not only to their peers but must get this information out to the rest of the education community.

Technical Support

One of the most important aspects of any software purchase or involvement in a research project is the amount of technical support that is given or purchased. Teachers and administrators need to assess the potential amount and kind of technical support which will be needed (based on variables such as computer experience, technological support on site, existing hardware and software, etc. . .) what type of technical support is preferred (phone support, e-mail support, web site support, site visits, etc. . .) and the type of technical support available. Typically users are given a set of instructions, several floppy disks or a CD, and a phone number or web site in case of difficulties. Updates to the software or patches that fix problems in the software are often available as a download from the vendor's web page. Unfortunately, both scenarios may require an experienced computer user depending on the design of the computer lab (i.e. Will the software be installed to stand alone machines, or to a network?).

Another important issue concerns the readiness of the site to receive technology support. Sometimes fixes to computer problems will require files to be sent to the vendor for investigation or files to be sent to the school via File Transfer Protocol (ftp). In other cases, some vendors may only provide technology support via e-mail or charge money for technical support provided over the phone. Typically, this is a charge per minute. In either case, the lab should be equipped with its own phone line for a modem or fax and a line that has long distance capabilities.

To better provide the school with methods to resolve support issues it is very beneficial to have e-mail and ftp software. For instance, if a student cannot progress past a specific point in the software the lab technician can compress that student's directory and send it to the research group for troubleshooting and evaluation. Without electronic transfer of the files teachers must copy the files to a floppy and mail them.

Evaluating the Effectiveness of Technology

In the past, measuring success was a simple matter of counting the number of computers in a classroom and dividing that number by the number of students and reporting how the ratio of computers to students had advanced. In addition to this poor indicator, several evaluations of exemplary programs have had significant methodological problems and it is questioned if the results could be replicated on a large scale (Wenglinsky, 1998). In fact, a number of large-scale ITS evaluations have been viewed as failures because of flaws in the experimental design, and lack of planning and implementation problems (Shute & Regian, 1993).

Recently the debate on technology's effectiveness has come into question. Criticism of technology has been flourishing in the media, and on Capital Hill, as lawmakers are considering cutting funds for technology (Trotter, 1998). Many people are asking if the investment of twenty years and billions of dollars has been worth it and the potential for backlash against school technology seems eminent. What is needed are several studies dealing with technological success in large field studies.

When looking at software, teachers and administrators need to address the results the software has had in the past e.g., What studies have been done? What were the research questions? What were the goals? Were the design and subjects listed? Were the results quantitative or qualitative? Is there anecdotal evidence given?

Summary

Technology is not, itself, a panacea for the problems facing educators today. However, thoughtful implementation of instructional technology can provide schools and teachers with powerful tools for student learning and collaboration.

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Making the Computer a Part of Teaching: A Piece of the Puzzle

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Abstract: This grounded theory study sought to develop a model of how teachers in a typical school made technology a part of teaching. This process was like fitting a new piece into a puzzle. There were two key concepts that propelled the teachers toward making the piece fit: knowledge and enjoyment. These concepts were related to each other in a spiral fashion. As knowledge increased, enjoyment increased. Two factors influenced this spiral movement of knowledge and enjoyment: students and resources. During the process, the other pieces of the teacher's puzzle changed in some way. The shape of the computer piece of the puzzle was very similar for all the teachers in this study. The majority of teachers used the computer as a supplement. The importance of context was demonstrated by the similarity of instructional use of technology and the lack of development of progressive practices.

Introduction and Review of the Literature

The use of technology serves as a perfect example of the constancy and change in public schools, a part of the cycle of never ending 'fads' (Cuban 1986). Changes come and go and yet many things remain the same. Since the early 1900's, a succession of new technologies have entered the classroom with the teacher usually being blamed for their failure to succeed. Cuban (1986, 1989) concluded that technological innovations go through a cycle of exhilaration, scientific credibility, disappointment, and blame. When a new innovation is introduced into schools there is much excitement about its potential in the general press. Scientific research then follows in an effort to back up this claim. When the studies fail to produce unequivocal support, the result is a search for whom to blame.

Cuban (1986) calls the teacher the gatekeeper of innovation, for it is the teacher who must implement the innovation. Regardless of the place or method of introduction, one result that is consistently found is that the teacher is the key factor in the success or lack of success in any initiative to put computers in the classroom (Collis 1996). Technology is not a silver bullet or magic box that will cure all our educational ills (Means, Olson, & Singh 1995). It is the teacher who will lead students to become comfortable, effective users of technology.

According to the 1995 Office of Technology Assessment (OTA) report, *Teachers and Technology,* there is relatively little research on how and why teachers use technology. "Most research about educational technology has focused on the impact of technology on students; little attention has been given to its impact on teachers" (Office of Technology Assessment 1995, p.51). Even in providing technology to schools our emphasis has been on student access and not teacher access (Hasselbring 1991).

As a way to further understand the introduction of computers into classrooms, some researchers have developed typologies of teachers and models of the process. These typologies classify teachers based on situation (Hadley & Sheingold 1993), practice (Honey & Moeller 1990), working style (Evans-Andris 1995), and interactions of personal factors and beliefs (Saye 1994). There are also models that take a development point of view and offer stages of adoption for both schools (Cory 1991; Cuban, 1986) and individual teachers (Collis 1996; Doornekamp & Carleer 1993; Marcinkiewicz & Regstad 1996; Sandholtz, Ringstaff & Dwyer, 1997). What these models of adoption have in common is that they seem to describe a process that begins when the computer is not considered in teaching to a time in which it is an occasional part of teaching and then to a time when it changes teaching. The majority of teachers seem to be somewhere in the middle of the continuum from non use to integration.

The search for how teachers can use technology effectively will not yield one right answer but

many. The type of research that will yield the kind of answers we need must do more than just ask if a particular approach works. Rather it will need to ask when, where, and how does technology work in real classrooms over time. More contextualized approaches to research can help educators understand the process of finding effective ways of using technology. The role of the teacher will become a critical element in these studies (Office of Technology Assessment 1995).

Much of the research that we do have about teachers and technology focuses on a very small population of teachers - the enthusiastic, exemplary, technology-using teachers (Becker 1994; Hadley & Sheingold 1993). Other research about technology-using teachers has come from technology rich environments where teachers have a large quantity of hardware, software, and technical support (Dwyer 1994; Dwyer, Ringstaff, & Sandholtz 1991; Ringstaff, Sandholtz, & Dwyer 1991; Sandholtz et al. 1997). We know very little about how teachers in typical schools with adequate or less than adequate technology resources are making decisions about using technology in their classrooms.

Methodology

This study sought to address the need for contextualized research on teachers and technology. Unlike other studies that have looked only at exemplary technology-using teachers or teachers in technology rich schools, this study examined how teachers in a single elementary school with typical technology resources made technology a part of their teaching. This purpose of this study was to build a grounded theory of how teachers make technology a part of their teaching in a specific context. The context is bounded by site, people, and time.

Eagleton school, a k-5 elementary school in the southeastern U.S., was chosen as a typical school based on its comparison to average school size and technology resources. (Pseudonyms are used for all schools and school personnel mentioned.) The average size of an elementary school in the United States is 471 students. Eagleton had 488 students (U. S. Department of Education 1997). The estimated student to computer ratio in the United States is seven to one (Viadero 1997). The ratio of students to computers at Eagleton was eight to one. All teachers had a teacher presentation station which included a multimedia computer, a large screen TV to project the computer screen, a VCR and a video disk player. Two teachers were designated as Special Computer Classroom teachers. In addition to the teacher presentation station setup that the other teachers had, these teachers had five student multimedia computers in their rooms. The Eagleton teachers described their school as being a warm, friendly school where the students come first. They considered each other to be good friends.

After an initial visit with the school principal, all other interviews and observations were of teachers. Data collection began in mid-October, 1997. All regular classroom teachers were asked to consider participating in the study during a regularly scheduled faculty meeting. Two of the 25 regular classroom teachers were on maternity leave for a large part of the school year. Of the 23 remaining teachers, 16 agreed to participate in the study.

Data collection and analysis began in late October, 1997. Interviews and observations continued throughout the school year, ending in late May, 1998. During the summer and early fall the grounded theory was presented to colleagues and participants as a part of evaluation and verification of the grounded theory.

The first type of data collected included demographic information about the teachers, staff, and students of the school. In addition, information about the number and location of computers was obtained. Initial interviews of all teachers who agreed to participate were conducted beginning in late October, 1997, and completed in early January, 1998. The initial interview questions were grouped into three areas: background information, technical knowledge, and technology and instructional practice.

All first round interview transcriptions and field notes were entered into a specialized qualitative analysis software package, NUD*IST, Non-numerical, Unstructured Data Indexing, Searching And Theorizing, (Richards & Richards 1997). Initial codes included emotions, specific people, the school, learning technology, instructional uses of computers, interactions concerning computers, children, resources, problem solving, personal use, and changes. As the coding continued, properties of the codes developed that grouped specific attributes of the categories. For example, under the code for instructional uses of computers, the properties were: amount of time the computers were used, ways teachers managed student use, use of computers in specific subjects, ideas and plans for using computers, reasons to use

computers, and computer roles in instruction. As new properties for the open codes were developed then previously coded interviews were re-examined for instances of the property.

After the initial round of data collection and analysis, a second round of interviews were conducted with 10 of the 16 participants. A surprising finding after the first round of interviews was the similarity of teachers on many of the initial categories. This made choosing teachers who represented certain properties impossible. Both of the Special Computer Classroom Teachers were included in the second round. Of the one-computer classroom teachers, participants were included based on grade level and amount of time they had had the computer. Two teachers from each grade level except kindergarten were included. For each grade level one teacher was included who had the computer for a year or more and one teacher was included who had gotten the computer within the last year. The kindergarten teachers were excluded from the second round because they had had their computers for only about a month at the time of the first round.

In the initial round of interviews the teachers used the concept of tool when describing how they used the computer. Specific interview questions for this round were about the ways that teachers talked about the purposes for technology and the reasons they used technology. The teachers were asked to define what they meant by teaching tool and to give examples of things that were teaching tools. They were also asked to compare technology to other tools. This second round of data collection was completed in late March. A third round of interviews was conducted in April and May to further clarify concepts from the initial two rounds of interviews. The questions for this round asked the teachers to describe how they used technology as a teaching tool, to explain why they used technology both in general and in specific situations, to describe changes that teachers noted in using technology during the past year, and how technology influenced teacher interactions.

In order to develop a theory that is conceptually rich, it is important to use different types of data. During the second and third round of interviews, six classroom observations and six meeting observations were also conducted. In addition to the interviews, classroom observations, and meeting observations other data collected included floor plans of all the participating teachers' classrooms, copies of county and school instructional planning documents, and teacher created instructional materials. All together there were 41 separate visits made to Eagleton from October until May.

After the second and third rounds of data collection and analysis were completed, the process of developing an initial model of the process of making technology a part of teaching began. The first step of theory development was to re-examine all field notes, interviews, and other data. Literature searches on relevant topics and examination of recent scholarly literature were conducted. The next step in the development of the theory was to re-examine the current coding scheme. Relationships among the codes were examined. All the data was re-coded with this new set of codes. As a result of the re-coding process, computer role was selected as the core category. A core category should occur frequently, link codes together, and explain variations in the data (Strauss 1987). The category provided a logical link to other frequent codes such as instructional setting, management, and knowledge. The teacher's perception of computer role can be used to explain differences between teachers.

Once a core category was selected the next step was to develop a narrative explaining the relationship of the categories that make up the theory. The theory was shared with some of the teachers participating in the study to see if the theory was applicable and useful for them. Based on these findings final changes were made.

Results

For the Eagleton teachers the process of making technology a part of teaching was like fitting a new piece into the puzzle that is their classroom. "I am trying to use them [computers] more in the classroom as a tool. I think it is overall like a big puzzle and you can say a piece of the puzzle you put together to further educate these kids" (Jeff).

As teachers are first introduced to the computer, they are unsure about how it works and exactly what to do with it. Uncertainty sets the stage for the beginning of a process of fitting the computer in the puzzle, of making the computer a part of teaching. The initial reasons for using the new tool are vague and unspecified. Teachers are amazed at the possibilities provided by the computer. As Dorothy expressed, "it is really terrific to think that you have this much at your fingertips if you know where to go for it." There is a feeling that "you need to learn technology because there are going to be more computers in the classroom

in a couple of years" (Alisha). Or as John explained, "we have got a nice computer there, there ought to be someone sitting there all day." One first grade teacher reasoned that the computer should be used "even if the only thing it does is make them not nervous around computers, then it has already served its purpose because when they get older then they are not afraid to mess with computers." In short, these teachers realize that technology will be a part of the future world of these children. Felicia expresses this when she replies that she uses the computer "because it is here, and it is expensive, and I know the kids need it; I know later on their jobs are going to require this skill, so I feel obligated. I really do."

How do teachers begin the process of making the computer a part of teaching? For the Eagleton teachers there are two key concepts that propelled them forward toward making the piece fit: knowledge and enjoyment. These two concepts are related to each other in a spiral fashion. Nikki expresses this relationship when she says that "this year has been a lot easier to where I am learning more of how to use it, so the more I learn how to use it to do different things on it, then I enjoy it more." As teachers increase their knowledge of the computer, they increase their acceptance and enjoyment of the computer. Or they can begin by increasing their acceptance and enjoyment of the computer which will increase their knowledge of the computer. The result is a spiral movement toward fitting the computer in the puzzle of classroom life. (Fig. 1).

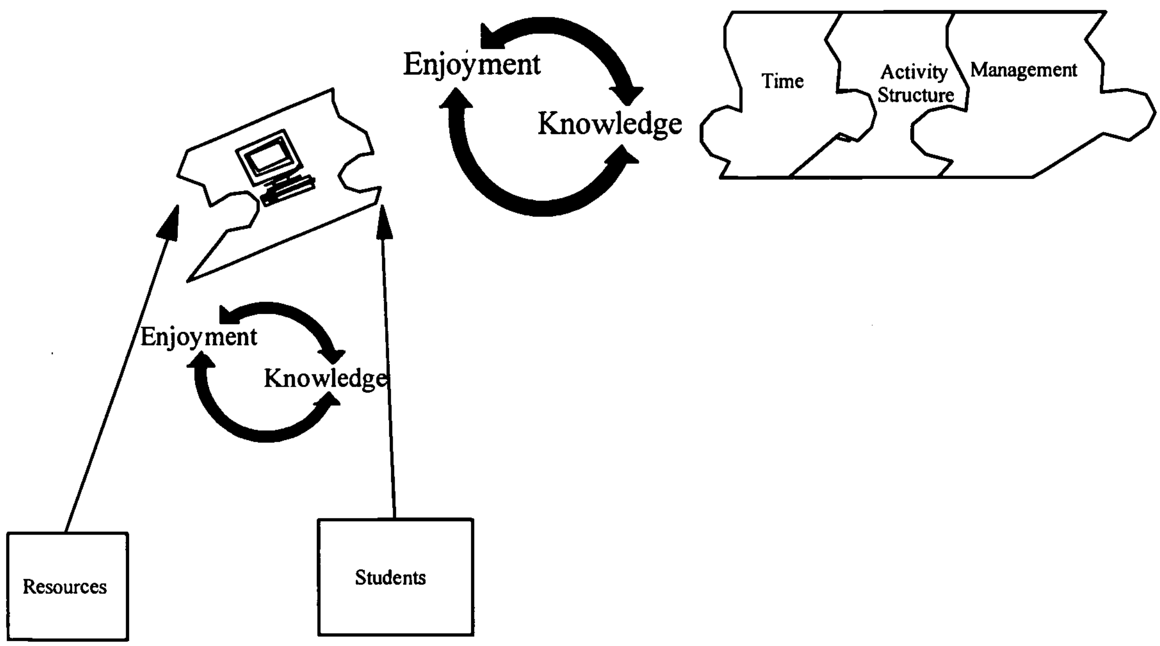

Figure 1: Fitting the Computer in the Puzzle

Knowledge develops along a continuum from a time in which teachers are dependent on the knowledge of others to a time when they are independent learners. An important part of moving forward on the knowledge continuum is the development of a foundation of basic knowledge. Teachers become able to learn new things by experimenting and "playing around." Enjoyment develops along a continuum from a time in which the computer is new and unfamiliar to teachers to a time when teachers are comfortable with and enjoy using the computer. An important part of moving forward along the enjoyment continuum is overcoming fear. Things that helped teachers overcome fear were technical support, encouragement from other teachers, and successful experiences with technology and a resulting sense of accomplishment. As a result of overcoming fear, teachers used the computer because they enjoyed it. They relied on the computer and wanted others to enjoy the computer.

There are many factors that will influence an individual teacher's process toward making the computer a part of teaching. These factors are grouped into two broad categories: students and resources. Students are mentioned by every teacher. More teachers mentioned the influence that students had in their decision making about using computers than any other single factor. Parents were mentioned as influencing

the decisions that teachers make about using the computer, but only briefly by three of the 16 teachers. In addition to the influence of students, the process of making the computer a part of teaching was influenced by the physical and human resources that were present in the context. The physical resources include hardware, software and physical space. There were two configurations of hardware at Eagleton: one-computer classrooms and Special Computer Classrooms. The software the Eagleton teachers used was mostly drill and practice. It was chosen by grade level committees of teachers from across the school system.

The human resources important in the adoption process were time and other teachers. Teachers must invest a substantial amount of time in the adoption process. The presence of support in the form of other teachers was important to the process. The first place that teachers went for help was other teachers, especially the Special Computer Classroom teachers who offered both technical support and encouragement.

As a result of the process of making the computer a part of teaching the other pieces of the puzzle, such as the decisions that teachers made about time devoted to learning activities, the structure of those activities, and the management of students while they were completing the activities, changed in some way. Teachers at Eagleton devoted class time to computer used either in a special time set aside to experience using the computer or during regular instructional activities to meet content objectives of specific subject areas. The most frequent use of the computer for most teachers with only one computer was with the whole group activity structure. Teachers also used computers with individuals during independent work time. Partners were used occasionally by teachers. Small groups were used less frequently. Teachers developed a series of routines to manage computer use. These routines fell into three types: routines to establish independent work skills, routines used during a special computer time, and routines for individual student use during independent work time.

For the Eagleton teachers, the computer is a part of their everyday lives. It is used for non-teaching tasks such as creating worksheets, calculating grades, and communicating with other teachers and staff. The shape of the computer piece of the puzzle was very similar for all the Eagleton teachers. The majority of teachers used the computer as a supplement, an extra. They see that the computer has potential as an instructional tool. They are still struggling to find ways to make use of that potential.

Each individual teacher has begun a gradual process of fitting the computer into the puzzle, spurred on by student interest and excitement about computers and growing resources. Some teachers were progressing at a slower pace than others, but all the teachers were moving forward. No single teacher had totally refused to use the computer.

Conclusions

What is striking about the results of this research is that the Eagleton teachers' routines and practices when using the computer were so very similar. Unlike other studies which report typologies of teachers based on computer use, there was no clear typology of teachers found in this study. The Eagleton teachers showed few developmental changes or stages. The Eagleton teachers did not report that the computer changed their practice. There was not a move toward progressive practices. The limited developmental stages and the similarity of instructional use of the computer demonstrated the importance of context in the process of making the computer a part of teaching.

In order for the computer to bring about educational change, educators will need to consider the context. Simply introducing the computer to teachers will not bring about educational change. When we introduce technology we need to set clear pedagogical goals for what we want that technology to accomplish. Teachers should be an integral part of the decision making process for it will be the common, typical teachers who will implement any goals that are set.

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First Year Teacher Distance Learning Network

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Abstract: This paper describes the design and field test of Minnesota's first year teacher induction program delivered via the internet. The distance delivery program is designed to facilitate the mentoring of beginning professionals into the field of education. To expand the support for both the first year teacher and their mentors, the Minnesota Legislature funded a distance delivery project to develop course work and web based strategies for assisting with the induction process of first year teachers.The cooperative project includes seven State Universities and the University of Minnesota.

Introduction

The support needs to insure successful induction into teaching is a critical factor in retention of new professionals into education. In the past, mentor teachers, administrators, and curriculum specialists have assisted the new teachers through the initial period of induction. In the United States today, we are at the beginning of a major turn over of experienced educators. Retirements and population growth in some parts of the country are resulting in the hiring of large numbers of beginning teachers to fill the instructional needs of school districts. Some of the beginning teachers may be serving with temporary liscensure. The need for ongoing, real time support for these new initiates into the field of teaching is and will be extensive. Without large numbers of experienced educators available to perform the formal and informal mentoring roles, the induction of these new teachers will be even more difficult than it typically has been in the past when less new professionals were entering the profession and greater numbers of experienced educators where available to provide mentoring support.

Much of Minnesota is characterize by regions of sparse population with consolidated regional school districts. The ability to readily access research, educational experts,etc.

can be a challenge. In addition, Minnesota is anticipating a dramatic turnover of educational staff in the next decade. Estimates of over 50 percent of existing educators will retire leaving many schools in Minnesota with a greater number of beginning and inexperienced staff than experienced staff. An example of this phenomena is a rural district in Northern Minnesota with a staff of twenty five. At present eleven of the faculty are beginning teachers.

The need for mentoring resources and support beyond the typical school based programs seems to be greater than ever before. One of the ways that Minnesota has identified to address the expanding need for the mentoring of new teachers at a time when large numbers of experienced professionals have and are soon planning to retire, is to implemented a first year teacher induction program supported extensively via distance delivery. The distance delivery strategy was made possible due to the fact that over the past decade, Minnesota has established an infrastructure which supports distance learning. All K-12 schools, Technical Colleges, and Universities have both internet and interactive television capabilities. With this infrastructure in place, the potential for supplementing the resource and communication needs of first year teachers and their mentors is a possibility.

Distance Learning Project Development

Higher Education Collaboration Model

Seven State Universities in Minnesota and the University of Minnesota were charged by the Minnesota Legislature to design a comprehensive support system for the induction of new teachers into the profession. The Legislature asked the collaborative to explore the potential of distance delivery options to provide an economical and effective mechanism for supporting beginning teacher successful induction into the career of teaching. An advisory council representing all of the public institutions in Minnesota met and collaboratively designed the distance learning teacher education induction project.

A call for proposals was distributed Spring of 1996 asking for proposals that would address the needs of beginning teachers and their mentors. The projects were required to include a web based component. Six projects were accepted. During the next year, a series of workshops and project sharing seminars where conducted. During the summer of 1997, all six projects were ready for full field test of their web based resources. During the 1998 - 99 academic year, the six pilot projects will be field tested. The pilot projects are diverse in topic and support. Current pilot projects reflect specific topics such as special education and stress management as well as a virtual web support site.

Field Test Design

The project field test will be implemented during the Fall of 1998 and conclude late Summer 1999.

A two tier field test approach will be implemented. At a comprehensive level, the project advisory council and central web site management team will field test the effectiveness of

the statewide web resources with a sample group of mentors and mentees. At an individual pilot test level, each pilot team will identify sample participants to react to their individual distance learning modules. All of these activities will be facilitated by the project management team via web based communications, interactive television meetings, and face to face seminars.

A third party evaluation team will add an important assessment dimension to the field test. The role of the evaluation team will be to work with the project advisory council and individual pilot projects to coordinate formative documentation of the field test activities. The team will be responsible for working with all project members in the development and conduct of a final report documents that would be distributed in traditional and electronic formats.

Field Test Goals

The primary goal of the field test is to determine the feasibility of the distance delivery model for mentors and mentees. The assumption of the Minnesota Legislature and those who have worked to develop the project is that mentors and mentees will see the distance support resources as a welcome extension of on site support. The rationale for the web based support reflected the following advantages. The flexibility of access to web based resources creates an environment that has the potential to answer questions, provide materials and research for the mentors and mentees at the time of the concern. Traditional mentoring strategies are by definition asynchronous. Another advantage to the web based support, would be the ability of mentors and mentees to interact with support that is not local. Often issues of beginning teachers are sensitive and political. Issues that the beginning teacher may be reticent to share with individuals who are in the same school environment.

Another goal of the field test, will be to identify the inservice needs of mentors and mentees to utilize web based chat forums and research resources. Based on limited testing of pilot modules during the 1997 - 98 year, it was determined that access to equipment and interenet connections where not as much of a limiting factor to the use of the web resources as was an understanding of how to maximize the information and how to communicate effectively via the internet.

Ultimately, the field test will be designed to assess the viability of the higher education collaborative to provide support for beginning educators. The project model would have implications for other teacher education programs, for other teacher inservice needs and perhaps other career fields that have a mentor mentee support need.

Summary

As a result of the field test, a refined model for the coordination, management, and development of a web environment for mentors and mentees should be developed. With the information gathered as a result of this project, a centralized web resource could be established to facilitate the addition of other support modules and web based resources

for mentors and mentees. Thus far, the individuals who have worked to create the pilot modules , beginning field test participants, and advisory council members have consistently shown excitement and enthusiasm for the potential for the distance learning support environment. Participants have been active in dialog related to the project development and conduct.

The need for first year support and effective communication between educators has always been a high priority need. The internet network has the potential to break down the isolation of the traditional teaching cubical. The job role of the teacher often is defined by physical isolation from other professionals and emotional isolation due to fears related to tenure review ,limited access for discussions due to school scheduling restraints, and ineffective communication inhibited by political concerns. The advent of internet networks provides expanded access to resources that are not limited by time of day or physical location. The distance learning mentorship project potentially adds another resources to the list of options for the ongoing support of education professionals both beginning and experienced.

The Electronic Portfolio in Graduate Education: Assessment Model for Pre-service Administrators

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Abstract: This roundtable discussion concerns the use of a portfolio-based assessment model as the foundation of a coherent system of evaluation for graduate students who are focusing on a career in either public school or higher education administration. Students in the Marshall University Graduate School of Education and Professional Development's Leadership Studies Program will submit on compact disc a portfolio which is based on reflective practice and constructivist learning principles, and which will replace the comprehensive examination. In addition to these pedagogical benefits, the electronic portfolio will serve as a portable credential and provide valuable experience to the administrator who has an interest in advocating the further integration of emerging technologies into the classroom.

Rationale

Educators of future school administrators have two fundamental responsibilities: one is to provide access to the knowledge, skills and attitudes necessary for their students' growth and development, and the other is to ensure the integrity of their programs of study. The faculty of Marshall University's graduate program in leadership studies are in the process of improving our accountability on both scores. We have been dissatisfied with the comprehensive and licensing examinations as instruments for evaluating both our potential graduates' abilities and the quality of our program. The examinations' deficiencies, as we see them, are multiple.

While the centrality of an accepted knowledge base is, as most accrediting agencies argue, a function of the kind of education reform currently sought, neither a standardized licensing test nor our own comprehensive exam with its open-ended questions provides a complete picture of the student's ability to perform as an educational administrator. Further, occurring as they do at the end of the student's program of study, they offer little recourse for intervention or remediation in the event of a negative result, other than to require the student to retake the exam.

Research in higher education reform as it relates to assessment has shifted significantly since the 1980s. A proliferation of studies and articles on the subject of alternative assessment, specifically portfolio assessment, has emerged and shows promising results (Darling-Hammond, 1995; Lyons, 1998; Schon, 1987; Schulman, 1988). Indications are that the construction of a portfolio featuring a student's personal and professional development through a program of study not only provides a richer and more complete representation of both the individual student's work and the quality of her/his program, but offers the student significant and ongoing opportunities to cultivate the habit of reflective practice as well. Since numerous studies have confirmed that the typical administrator's day is characterized by "overload and fragmentation" (Fullan, 1991, p. 148), the need for reflection is crucial for this group of professionals.

The Electronic Portfolio

The goal of our project is to develop a portfolio-based approach as the foundation of a coherent system of evaluation for pre-service administrators. Building on the success of portfolio-based assessments in pre-service teacher education programs (e.g., the Stanford Teacher Assessment Project, the Teacher Portfolio Project at the University of Southern Maine, and the student assessment project at Alverno College), we have established as an objective the development of a portfolio assessment for pre-service administrators that is consistent with licensing requirements; is based on reflective practice and

constructivist learning principles; is evaluated systematically on an ongoing basis; and is presented in an electronic format for ease of handling and evaluation, and for portability.

We have identified an organizational framework which corresponds to the 36-hour program of study for the master's degree in leadership studies. The completed portfolio will feature twelve entries, one per course, based on the standards articulated by the Interstate School Leaders' Licensure Consortium (ISLLC) and congruent with the content tested by the licensing examination (the Praxis). All course syllabi and content are being reviewed to ensure recognition and observation of those standards. The twelve entries will be complemented by three reflective pieces – one at the beginning, middle and end of the portfolio – which address the student's reason(s) for entering the program, i.e., specific interest(s) in leadership studies, and plans for professional growth. These reflective entries will provide a thematic basis for the portfolio, tying together the twelve entries in a coherent display of the student's individual interests and development.

Discussions with the university's Center for Instructional Technology concerning the electronic format have identified both the hardware and software for the project. At least three workstations will be provided in the computer lab for students to use, and those who wish to purchase equipment will be provided a list of specifications. The issue of technical support for students who need assistance is being resolved as well.

Conceptual Issues

While using the standards assessed by the licensing examination, i.e., propositional knowledge, serves the functionalist task of providing an organizational framework for the portfolio, faculty still need to address the conceptual issues related to ensuring that their course content and portfolio assignments are sufficiently broad to incorporate the constructivist principle of developing procedural knowledge. Content and assignments must allow for experience in actualizing knowledge in practice, enabling students to acquire the skills needed for their continued growth and development after they leave the program. It will also be necessary to design an evaluation system for the portfolio itself which specifies the criteria for assessment, and to share that information with students as well as expectations related to design and presentation.

We will be field-testing the project with MUGC students in the Leadership Studies Program and with students in educational administration programs at two other universities. A formative evaluation will be conducted after two semesters to determine the need for modification before the second year of the field test. A summative evaluation incorporating both quantitative and qualitative components will be conducted at the end of the second year of the field test, using both internal and external evaluators.

In a word of caution to those who would prescribe a static knowledge base for educational administration, Schulman argued that we could achieve standards without standardization (1987). Our project to augment the acquisition of propositional knowledge assessed by the licensing examination with the development of procedural knowledge demonstrated in the construction of a portfolio is such an effort.

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Teaching and Learning with Technology: A Professional Development Model

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Abstract: Technology provides powerful new opportunities to enrich student learning across the curriculum. In order for students to have access to these new tools in meaningful ways, their teachers must be skilled in the use of technology as it applies to the curriculum. This paper describes a professional development program that assists teachers in gaining new skills, processes, and ways of thinking. The courses in this program use a project–based approach to meet staff development needs. Participants' evaluation of the program has been very favorable but the effect of the program won't be known for years to come. We would hope to see changes that ultimately have a positive effect on student learning.

Background

The province of Alberta has released an interim curriculum in information and communication technology. This document highlights technology learning outcomes for Kindergarten to Grade 12 students (see http://ednet.edc.gov.ab.ca/techoutcomes/). The new curriculum, which becomes mandatory in June 2000, is not intended to be taught as a separate course but rather to be absorbed within existing courses. For example, students will acquire spreadsheet skills in the context of solving problems in mathematics or science. Despite concerns over the role of technology in schools and the tremendous expense incurred, school districts in Alberta, like the rest of North America, are rapidly purchasing equipment and software and building an infrastructure to support technology integration. Perhaps, the greatest obstacle to technology integration is not the lack of equipment but the lack of expertise needed to integrate technology effectively into the curriculum.

Alberta, like the rest of world, faces the immense task of inservicing its teachers to prepare them for technology integration. Various stakeholders (school districts, teacher's association, administration, universities) across the province naturally gravitated together and formed a committee to develop a technology inservice plan. Government and corporate agendas did not drive the committee; instead it was driven by the belief that technology integrated into constructivist activities would enhance student learning. In other words, the ultimate goal of this professional development plan is to ensure students will use technology to enhance learning across the curriculum. We envision students using appropriate technology to support higher cognitive level activities. The project is called Teaching and Learning with Technology (TLT).

TLT Project

Beginning with the end in mind, the committee worked backwards. That is, to reach the goal that all students will use technology to enhance learning across the curriculum, teachers must have access to and be

knowledgeable and skilled in using technology. In order for teachers to gain the technological attributes, knowledge, and skills they need, they must receive appropriate training through pre-service or inservice programs. In order to plan pre-service or inservice programs, the needs of teachers must be identified. Thus the first step was to define professional development needs that would guide the development of a program for teachers and administrators.

Focus group sessions were held with more than 150 teachers and representatives from districts, professional development consortia, universities, and Alberta Teachers' Association specialist councils. Focus group facilitators synthesized information provided by the participants and stated the identified professional development needs in terms of attributes, knowledge, and skills for K-12 teachers of Language Arts, Mathematics, Science, and Social Studies. Each of the attributes is further broken down into specific knowledge and skills for each of the subject area identified. These can be viewed at the TLT web site (http://tlt.edmonton.ab.ca/). Although the knowledge, skills and attributes have been identified by other sources it was important for Alberta teachers to feel ownership in the identification of their professional needs in the context of events in the province. Nonetheless the goals are very similar to other goals developed by groups such as the ISTE (see http://cnets.iste.org/).

Once the goals for teachers were identified effort was directed toward constructing a plan to meet those goals. The planning committee recognized that meeting these goals involved moving teachers through various phases of adoption. Reflecting on our own experiences in developing our skills and in helping others acquire skills, we identified four phases of adoption (entry level, early adoption, mature adoption, and innovation). Similar stages of development were identified in the Apple Classrooms of Tomorrow (ACOT) project (Sandholtz, Ringstaff, & Dwyer, 1997) and by Leithwood (1990) who looked at teachers' growing expertise in the use of computers. In the ACOT project teachers using computers moved from an adoption phase (concern was over the technology itself) to an appropriation /invention phase (discovering powerful learning experiences for students).

In the TLT project, the 'early adoption' phase is one in which the teacher is tentatively trying new things but technology has not become a regular and comfortable part of the teaching repertoire. Teachers at this early phase are more inclined to use technology as a demonstration device or to use pre-designed structured activities with students. They use productivity tools to automate tasks such as writing progress reports. Teachers at the early adoption phase must be encouraged and supported as they learn. As they observe positive changes in student learning their beliefs and attitudes about technology begin to change.

With experience and the opportunity to use many different applications, the teacher evolves into the 'mature adoption' phase in which technology is used regularly and confidently. Teachers at this phase provide more opportunities for students to initiate the use of technology. They are more likely to facilitate learning rather than deliver learning, using technology to take advantage of the teachable moment in a real-life context. They use productivity tools to work with information in ways that have the potential to improve student learning. Teachers at this phase often become mentors for their colleagues.

A few teachers progress even further to a stage in which they create new and meaningful ways of using technology to support teaching and learning. Their confidence in teaching with the technology enables them to experiment more with new strategies in the classroom. These individuals are mentors for their colleagues but also provide leadership at the school and district level.

Recognizing that various stages existed, we developed a model that would support the transition from one phase to the next. Thus three programs were developed: Program 1 was designed to take a participant from entry level to early adoption; Program 2 from early adoption to mature adoption and Program 3 from mature adoption to innovator. Research has shown that movement through these phases can take several years (President's Committee of Advisors on Science and Technology, 1997; Sandholtz & Ringstaff, 1996). The three programs are briefly described below.

Program 1 - Skill-building Program

The Skill-building Program is for everyone who has something more to learn about technology. At the most basic level, it provides the novice with basic operational skills such as file management and simple word processing. At advanced levels, it provides specialized skills such as web page design and multimedia production. Many of the courses offered at this level are short in duration (3-6 hours) and provide information in a specific area. Most professional develop activities in the past have concentrated on this level.

Program 2 - Technology across the Curriculum

This program provides support to teachers using technology to enhance student learning in language arts, mathematics, science, and social studies. The teachers may be integrating technology for the first time or they may be relatively experienced and confident. Because of the nature of the program, everyone has the opportunity to learn and grow according to their personal strengths, interests, and needs.

The program is organized so that factors such as subject, grade level, technology, and experience of the participants are accounted for in a manner that will meet the needs of the local teachers, schools and districts. The prime emphasis of this program is to create teaching plans and materials and, through this process, empower teachers to use technology effectively. The teachers must create teaching plans that meet specific needs and takes into account the resources available. These plans are posted on the TLT web site so that project ideas fitting into Alberta curriculum can be accumulated. Teachers are encouraged to view existing projects and to provide feedback.

The Technology across the Curriculum Program consists of two parts. The first part is one in which teachers work together to plan projects suitable for use with their students. This may occur in many different ways such as during a one-week summer workshop, during a series of early dismissal workshops throughout the school year, or during a combination of school professional development days and teachers' convention days. The second part involves teachers field-testing their projects by working with their students. During this process, the teachers will refine their plans and materials prior to sharing their work. There are opportunities for teachers to collaborate following the program either through face-to-face meetings or through electronic mail.

Program 3 - Technology Leadership and Mentorship Program

Technology mentors are educators who support teachers in their professional development in using technology across the curriculum. An important component of the TLT plan is to establish a core network of mentors that will have an influence at every level of education. Participants of this program should be exemplary teachers that use basic and specialized technology tools in their teaching. In many cases the participants are already mentoring other teachers, either formally or informally. Through this program, participants learn to facilitate and support the learning of their colleagues rather than adopting the role of an expert.

The program is also organized in the same manner as Program 2. The prime emphasis of this program is for mentors to create plans and materials that can be used in the delivery of Program 2. By working with other mentors, participants learn how to facilitate and support the professional development of others. The plans developed in this program are shared at the TLT web site. There is no obligation to conduct courses or workshops after taking the Mentorship Program but there is an expectation that the mentors will work with their colleagues. The resources available in schools and districts varies considerably and it is important for the mentor to help teachers understand what is feasible.

The Technology Mentorship Program consists of two parts. The first part is one in which mentors work together to plan projects suitable for use with participants of the Technology across the Curriculum Program. This may occur during a one-week workshop during the summer or during a series of Friday-Saturday workshops throughout the school year. The second part involves technology mentors working with a cohort group to implement the professional development activities. During this process, the mentors refine their plans and materials prior to sharing their work. There are continued opportunities for technology mentors to collaborate following the program.

Program 1 has been well established for many years now thus the action plan for TLT focused more on Programs 2 and 3. A cascade model is being developed that concentrates first on building a strong team of mentors that can go back to their own districts. These mentors will be able to offer support to their colleagues, which is an important factor in staff development. Some school districts have recognizes the importance of this role by providing reduced teaching loads to mentors. Those individuals that take on this task as an add on to their present duties are unlikely to succeed. In this project, it is crucial that mentors have administrators who recognize the complexities of technology integration and are willing to provide the necessary release time for professional development.

Project-Based Learning

The courses offered by the professional development consortia attain their goals through constructivist approaches. It was imperative that we walked the talk. In fact, developing technology skills is only part of the

solution for effective integration because enhancements to student learning are far more likely occur if constructivist activities are used. That is, we had to work on getting teachers, especially those in Program 2 courses, to change their view of teaching and learning. Keith Yocam was involved in staff development in the ACOT study and observed that " It seems far easier to help a teacher who is already practicing constructivist methods learn to use technology to enhance student learning than it is to help a teacher who has a lot of knowledge about technology but limited knowledge of constructivist pedagogy" (Yocam, 1996, p.268). This most certainly has been our experience as well. In the TLT project we were asking teachers to develop projects that would "engage" the learner, therefore they would have to experience student-centered learning activities (Sparks, 1996). If teachers had positive experiences as participants in a student-centered class they would most likely consider trying a similar approach in their own class. Teachers applying constructivist approaches are encouraged by the positive effects on their students. As teachers experience success with new approaches they start to change their beliefs. The new beliefs become potent and permanent if the group surrounding the individual share the belief. (Schein, 1985). In essence then technology integration has really been the impetus for school reform since it forces educators to re-examine their beliefs about teaching and learning (Caverly, Peterson, & Mandeville, 1997 and David, 1994).

The courses developed for the TLT program use a project-based approach. Project-based learning addresses many of the premises adhered to by social constructivists. The following 12 principles guided the development of course activities.

1. The PD activity must be linked to curriculum standards and teachers' professional development needs. Professional development projects and tasks are developed using the curriculum standards and the PD needs identified by teachers during the TLT development work.
2. The PD activity will incorporate opportunities for choice and personal application by the teacher. The project-based tasks will be general in nature and teachers will define the context for their learning based on their classroom and school variables. Classroom variables would include grade level, curriculum area, unit of study and student needs. School variables would include access to hardware, software and instructional time. For example, one teacher may be working with grade five students, in Science, on an electricity unit and have four computers in the classroom equipped with a simple spreadsheet. Another teacher in the same course may be working with grade 3 students, on a rocks and minerals unit and have access to a lab of computers equipped with spreadsheets, data bases and Internet connections. Both teachers may be working on the same task but each will personalize it to their context.
3. Technology mentors (course instructors) must model appropriate instructional techniques for integrating technology. Mentors will use instructional methods that encourage independent learning and problem solving. Mentors will use a range of strategies including direct instruction, whole group practice, discussion, demonstration, individualized instruction and problem solving. Participants will have the opportunity to reflect on the instructional strategies being used and compare them to the strategies they currently use in their classroom.
4. The PD activity will result in a usable classroom process and product. Teachers will create materials suitable to the curriculum they are teaching. All teacher-produced materials and instructional strategies will be compiled and shared with all the participants. This information will contribute to a collection of professional curriculum resources to support teaching and learning with technology.
5. The PD activity must accommodate the different skill levels of participants. The project-based approach allows learners to adapt the task to match their personal learning needs. Participants will have the opportunity to work collaboratively with other participants. Participants who have a high skill level will develop more complex tasks and those with low levels of skill will work through the task at a more basic level.
6. The project-based approach will encourage the development of skills for independent learning and problem solving. Workshop instruction will encourage the use of reference and help materials available with the hardware and software. Participants will also learn short cuts and trouble-shooting techniques that apply to the task.
7. The project-based approach will allow participants to experience and observe the capabilities of the technology. Teachers will work on different variations of the same task and will share their materials and strategies at the end of the workshop. Using this approach, participants will have the opportunity to see many aspects and applications of the technology.
8. Teachers will practice their instructional strategies and will receive feedback from their colleagues. At the end of each course teachers will present their finished task and receive feedback from the other participants.

This activity will encourage the development of instructional strategies that effectively integrate technology.

9. The technological skills and pedagogical skills that teachers will learn in each project-based task will be identified. Teachers will use a skill checklist for course selection. The checklist will also be used by PD organizers to advertise courses and by participants to assess their learning. This checklist of skills will be useful to teachers as they develop and implement their Individual Professional Growth Plans (a requirement of all Alberta teachers).
10. The program must be flexible and accommodate a range of delivery situations. Tasks will vary in length and complexity. Some tasks may be accomplished in one hour while others may take five or six hours. PD organizers will be able to choose tasks suitable to different situations such as institute days, specialist council conferences, teachers' convention, after-school and full day sessions.
11. Teachers need to understand the implications of technology on the classroom, career and personal life. There are immediate and long-term implications that arise from the integration of technology. Teachers and their students must have the opportunity to study and evaluate the risks, costs and benefits of technology.
12. The PD program and materials will have longevity. New projects will continue to be developed by mentors and teachers as curricula change. Of course, some of the tasks will be general enough in nature that they will continue to apply even as curricula change.

Results

Alberta has approximately 28,000 teachers, the majority of which have indicated technology integration as a professional development priority. Course delivery of the new program began in May 1998. Between May and August there were 487 participants. This may appear to be a mere trickle but 157 of those participants were in the Technology Leadership and Mentorship Program. These participants are preparing their own PD courses for their district or school as well as grooming others for the mentor role.

The evaluations of the courses delivered have been very positive. Of the participants surveyed, 81% believed that they had benefited professionally from the courses. The remaining 19% agreed somewhat that they had benefited professionally from the courses. The comments from participants however, is even more revealing in terms of evaluation. Below are some typical comments made by teachers:

- I came to the realization that it is so important to build from the curriculum rather than technology in the center.
- I was very pleased with the unit we produced. Within "developing the unit" I was able to learn so many related facts, it was truly worthwhile.
- A great week – the new ideas and the discussions gave me a lot to plan with and think about.

The majority of teachers felt that the courses had enlightened them to think about new approaches to teaching. The collegial nature and the collaborative learning activities were considered the strongest features of the courses. This feedback however, only indicates the teachers' impressions of the courses. A more extensive evaluation is underway to determine the effects of this professional development in bringing about change and the effects on student learning. The long-term evaluation of the TLT project will involve surveying and viewing TLT participants in their classroom or in their mentoring roles. It will involve an examination of students' higher level cognitive learning. Thus it will take several years to complete the evaluation of the TLT project.

Evaluation of the program is further complicated by the absence of critical factors that are needed for successful implementation of this professional development model. Funding, time, and support are necessary components. That is, the funding has to be available to provide the infrastructure within the school. Teachers need time to learn, apply, practice, reflect, and collaborate. Mentors need time to plan and time to meet with their proteges. Support both in terms of the curriculum and the hardware are required in every school. If any one of these factors is missing the professional development falls short of its goal. For that reason we strongly urge participants to ensure the proper conditions are in place before enrolling in a course.

Conclusion

There are many challenges that need to be addressed as we integrate technology into the curriculum. It is a complex task that relies on many interrelated variables such as funding, time, professional development and support. We choose to focus on the area of professional development because it is often neglected in technology plans. Most school districts allocate less than 15% of their technology budget to professional development instead of the conservative recommendation of 30% (President's Committee of Advisors on Science and Technology, 1997). We would recommend a project-based approach for professional development that is authentic, collaborative, and reflective. Many of us involved in the planning of this model have grown professionally. We experienced all the outcomes associated with project-based learning and have found the process encouraging and rewarding. It forced us to confront our beliefs about teaching and learning and make them explicit through our actions. It appears this professional development plan has had the same effect on its participants.

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Discovery Learning for Grownups? Preservice Teacher Education and Technology

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Abstract: This paper is a report on the technology orientation experienced by students in the University of California, Berkeley's Developmental Teacher Education (DTE) Program. The paper discusses the author's efforts to make the technology curriculum of the program consistent with the constructivist ideology which provides the theoretical frame for the two-year M.A./ Multiple Subject Credential Program. The DTE students participated in a three-day "technology scavenger hunt," which required that they work in teams to decipher clues using various technologies. The purpose was that the students discover and use their own problem-solving strategies to understand and utilize unfamiliar technology resources. Students expressed great enthusiasm for the orientation experience, which fueled their efforts to utilize technology in their student teaching placements.

Introduction

"Ohmygod, that is so COOL!"

As teachers, we expect to hear comments like this from our students, especially when computers are involved. Teachers often refer to children's "natural affinity for computers," while disparaging their own lack of technological expertise. At Developmental Teacher Education at the University of California at Berkeley (http://www-gse.berkeley.edu/program/dte), we are trying to sow the seeds of excitement about technological possibilities before our teachers enter the classroom, so that they not only are familiar with current technologies, but are prepared to teach themselves and their students about technologies that have not yet been invented.

Developmental Teacher Education (DTE) is a two-year M.A. (Ed.) and Multiple Subject Credential Program. The program is based on a constructivist paradigm, with coursework designed to prepare teachers who will facilitate and elicit learning from their students as much as they will "instruct" children. However, the technology component of the curriculum remained, until two years ago, largely "show and tell"-based. There was very little room for student discovery, creativity, and freedom in learning about the role of technology in their own lives as well as their classrooms.

Two years ago, I assumed responsibility for coordinating the technology component of the credential. I wanted to create a technology curriculum for DTE in which students would *learn how to learn about technology*, not just learn specific programs, hardware, peripherals, etc. I wanted students to empower themselves with the knowledge that they could develop strategies for learning about any new technology, using their own experiences, those of their friends, and information on the web as resources.

To that end, I developed a "Technology Scavenger Hunt" which would welcome the students to their two year course of study at Berkeley, introduce them to the various technologies they would be expected to use immediately, most notably e-mail and web browsers, and create an environment in which learning these technologies would not be the end-goal of the project, but a means to another end. I wanted the students to learn these technologies on their way to discovering something else.

Developing the "Scavenger Hunt"

The University of California campus is enormous, and students had remarked that it was easy to become isolated in the Graduate School of Education, on the Northwest corner of campus. I decided to create a series of clues that would lead the students around the campus in groups, and require that they successfully learn a particular technology in order to proceed to the next clue.

I wanted to make sure that the student teachers became familiar with some of the technology they would be expected to use immediately, such as email and web searching, as well as some of the technologies they might come into contact with in their student teaching placements, such as Hyperstudio (http://www.hyperstudio.com), ClarisWorks (http://www.apple.com), and Microworlds (http://www.microworlds.com). I also wanted to ensure that the students were exposed to the resources available in the Graduate School of Education's Corey Computer Lab, so that even in the case that their placement schools did not have extensive technology resources, the DTE student teachers could still engage their students in technological pursuits. I wrote a series of five complex clues, each of which required that the student teachers learn about a particular technology resource and demonstrate their competence in that resource. For example, students received a message written entirely in Morse code, with an accompanying clue suggesting that they use a search engine to find a Morse code alphabet. Another clue required that they set up an email account, send me an email, retrieve my response, open the attached file, and proceed according to its instructions. A third challenged students to set up a Hyperstudio stack with each of their faces on it. I did not specify the exact process by which they were to meet each challenge, because I wanted to leave each clue open to each group's brainstorms.

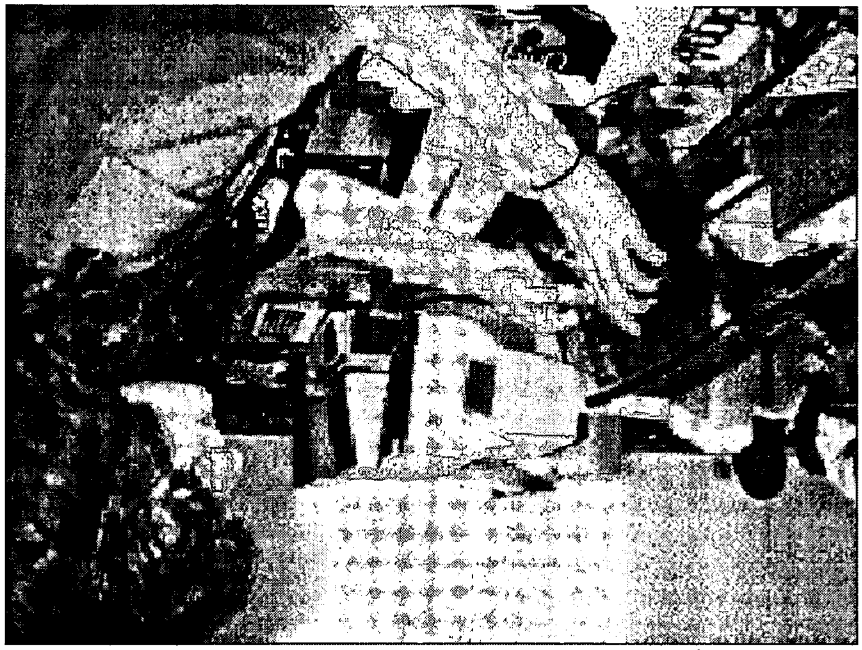
The Hunt Begins

When the students arrived to the School of Education computer lab that Monday morning, I asked them all to draw a picture of their face in response to the question, "How competent do you think you are with computers?" Not surprisingly, many of the students drew either faces of consternation, confusion, or tentative smiles. None radiated confidence. I explained to the students that they were going to participate in a scavenger hunt, that each group would have to get through successfully before the entire group of twenty would be able to finish. I told them that they could use anything at all as resources, but that I was not going to "teach" anything in exhaustion.

DTE students group themselves into teams for the scavenger hunt.

I asked them to separate themselves into groups of four or five, making sure to include at least one person who was comfortable with word puzzles and one person who was comfortable with computers. Then I gave them their initial clues. The buzz of excitement that filled the room was palpable, as some realized their clue required that they "read" a clue from a sheet of blank paper (they had a hint to talk to a DTE staff member who provided them with an invisible ink "revealing" pen) and others sped off in response to directions that led them to the other side of campus.

Over the course of three days, the students worked their way through the five clues with their teammates. After all groups had completed all their tasks, each group received an overhead transparency map of the campus, which they had to combine to discover where to go for the final clue.



A DTE student combines the overhead clues to find the students' final destination.

When they returned to the lab, all the students were excited to show the others what they'd learned, the projects they'd created, and the roadblocks they'd encountered. More importantly, when I asked them to draw another face reflecting their attitudes towards computers, all showed either tentative smiles or wide grins, many with comments scribbled in the margins: "I don't know everything, but I have a better idea of where to find out", "It was so great to work with other people, that way we could figure something out that we wouldn't have been able to do alone."

Where Do We Go From Here? Extending the Orientation Experience

The technology part of the Developmental Teacher Education Program is continually evolving. As a credential program, we are responsive to changing standards for technology at the State level. As of this writing, the California Commission on Teacher Credentialing is developing a new set of technology standards. By creating an open framework for student teachers' work with technology over their two years in the program, we can adjust the particularities of the framework to remain consistent with State standards.

As it stands now, the technology orientation leads into a series of four technology strands that the students pursue over the course of the program: Communication, Graphic Design and Publishing, Multimedia, and Programming. Student teachers are expected to identify for themselves one or two strands over the semester that they will address through collaboration with other student teachers, increasing their knowledge of the component technologies and developing projects incorporating those technologies.

DTE students scan photos for a Hyperstudio stack.

The Communication strand, as it stands now, will challenge students to develop projects involving email, newsgroups, chat, and online mentoring relationships. The Graphic Design strand will challenge student teachers to creative innovative graphic presentations, for their own work as well as through "publishing" the work of their students, by familiarizing themselves with digital photography, scanning, and various presentation formats, from ClarisWorks to Photoshop to HTML. The Multimedia strand will introduce the synthesis of audio, video, and visual/ graphic resources in programs such as Hyperstudio and Powerpoint among others. The Programming strand will challenge student teachers to create innovative, interactive programs for use in their classrooms, through the use of Microworlds' Logo software as well as beginning Javascript for classroom websites.

What Can Other Preservice Teacher Education Programs Do?

Technology and preservice teacher education have unfortunately been awkward bedfellows. Through the attempts of credentialing programs to exhaustively "prepare" their students by ensuring that students have experience with particular operating systems or programs, teachers enter the field with a realm of knowledge that has an expiration date. By making technology in teacher education oriented towards problem-solving and the creation of their own algorithms to address the challenges of unfamiliar hardware and software (Papert 1992), teacher credentialing programs can prepare teachers who are not only able to interact with contemporary educational technologies, but with those innovations which have yet to emerge.

A DTE student works on a web page.

Whether through creating their own "technology scavenger hunts," or by finding other ways to infuse technology curriculum with a constructivist perspective, teacher preparation programs must find ways of building bridges between student teachers' existing realms of expertise and technological competence. In that way, teachers, who have been traditionally at the margins of technology use, can overcome their fear, discover that expertise is not the domain of a select few, and can pass on that innovative and problem-solving approach to their students.

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Sky's the Limit Charter School: Offering A Tutor-based Curriculum

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Abstract: This paper presents a mapping of kindergarten through grade 12 curriculum content with existing educational software available on CD ROM. The software ranges in price approximately from \$5 to \$100. Computer-based training and other tutoring methods will be a major component of a new charter school in San Antonio, Texas. Most topics in the curriculum are available in software. Topics that are not covered by existing software may be easily created with current authoring tools.

With the availability of CD ROM technology over the past few years, there have been a multitude of software tools and educational products produced and put on the market. Most of the computer-based training (CBT) systems have been reviewed and tested for their usability and their pleasing user interface. However, very few of these educational software systems have been tested for their teaching and learning effectiveness. In fact, the more complex intelligent tutoring systems (ITSs) have typically been more rigorously tested for effectiveness. An ITS is similar to a CBT system where a student's performance is tracked and the student model is used to make instructional decisions (Wenger 1987; Goettl, Halff, Redfield, & Shute 1998). The typical CBT systems and 'edutainment' software that are available have not undergone learning effectiveness studies. A new charter school may be able to study their effectiveness.

One-on-one tutoring has been shown to be one of the most effective methods of instruction for student learning (Bloom 1984). There is an opportunity to perform some of these tests at a new charter school in San Antonio, Texas called Sky's the Limit Charter School. The core curriculum will be made available to the students through various instructional methods. Many of the typical junior high and high school courses will be offered not only in the traditional classroom lecture and discussion approach, but also in a tutoring format that will consist of utilizing CBT/ITS, as well as peer and instructor tutoring. In addition, some courses will be offered in a mentoring and experience-based approach. Peer and parent tutoring will be made available to all the students at the school, especially before and after regular class hours.

In the tutoring format, the instructor serves as a guide for selecting instruction and a troubleshooting tutor as needed for the students. With CBT/ITS courses, teachers begin to take on other roles of observation, intervention and facilitation. The teachers will be regularly interviewed about their changing roles and asked what they need to support their job. Students will be given pre-tests and post-tests that will be used to study the instructional effectiveness of the CBT and ITS tools used at the school.

This paper shows a set of the software titles that cover much of the K-12 curriculum. The courses and topics are taken from the Texas public school requirements known as the Texas Essential Knowledge and Skills (from the Texas Education Agency). When a topic has no associated software, instructors may be able to create their own tutors using an authoring tutor such as XAIDA (Experimental Advanced Instructional Design Advisor) (Hsieh, Halff & Redfield 1998). XAIDA is very easy to use and has been shown to create effective multimedia instruction. The following tables map course topics to software titles covering the basic curriculum for elementary, middle and high school grades.

The main companies currently creating educational software are The Learning Company, Knowledge Adventure, Disney Interactive, Microsoft, Edmark and Humongous Entertainment. Many software packages can be ordered online from Edutainment Catalog (www.edutainco.com), BrainPlay (www.brainplay.com), and SmartFun (www.smartfun.com). There are also CD ROMs that have many educational programs covering multiple topics at many levels: *The Best Educational Software of '95* (Microforum), *CD Schoolhouse* (Authentic Shareware), *Education: The Learning Journey* (Quantum Axcess), *The Education Master 2nd Edition* (Advantage Plus), and *Games and Education 3.0* (BeachWare). Many of the CD ROMs above require at least a 486 PC or later, 33 or more Mhz, 16 or more MB RAM, 256 color SVGA, sound card, speakers, and a 4x CD ROM.

One topic not covered at each of the levels is physical education. Tutors could be developed to teach the academic and cognitive components of these classes. Two other topics are not covered: primary language for bilingual education, and Texas history. Software for the primary language (such as teaching Spanish in Spanish) may be available in other countries and could be developed. Texas history could easily be developed as CBT lessons. Also, some areas of business and vocational education were not taught in a software package. These are exciting times that we live in for new modes of instruction and teaching including the potential uses of CBT/ITS and the Internet. If you have any other suggestions for sources of good instructional software, please contact the author of this paper!

Elementary School Course/Topic	**Software (Publisher)**
Elementary	Blaster 3R's (Knowledge Adventure) Clue Finder's 3rd Grade Adventures (The Learning Company) Clue Finder's 4th Grade Adventures (The Learning Company) Deluxe Math Rabbit (The Learning Company) Get Smart for Kids (Quantum Axcess) It's Elementary 2.0 (Knowledge Adventure) JumpStart: First Grade (Knowledge Adventure) Reader Rabbit's 1st Grade (The Learning Company) Reader Rabbit's 2nd Grade (The Learning Company) Schoolhouse Rock 1&2, 3&4, 1-4 Math, America Rock, Grammar Rock, Exploration Station (Creative Wonders) Yearn2Learn Peanuts & Snoopy (Image Smith)
Kindergarten	Animal Alphabet (REMedia) BusyTown (Paramount Interactive) Fisher-Price Ready for School: Kindergarten Edition (Knowledge Adventure) I'm Ready for Kindergarten: Huggly's Sleepover (Scholastic) JumpStart: Kindergarten (Knowledge Adventure) JumpStart Toddler (Scholastic) Kid's Zoo: A Baby Animal Adventure (Knowledge Adventure) Reader Rabbit's Kindergarten (REMedia) Sesame Street: Let's Make a Word (EA Kids/Creative Wonders) Sesame Street Numbers (EA Kids/Creative Wonders)
English as a Second Language	Hablemos Ingles (The Learning Company)
English Language Arts	Read, Write and Type (The Learning Company)
Reading	Just Grandma and Me (Living Books) Kid Phonics; Kid Phonics 2 (Davidson) Let's Go Read 1 and 2 (Edmark) Me and My world (SoftKey) Reading Blaster (Knowledge Adventure) Reader Rabbit's Reading Journey (The Learning Company) Reader Rabbit's Reading Library Level 1 and 2 (The Learning Company) Super Solvers Midnight Rescue! (The Learning Company) Super Solvers Spellbound! (The Learning Company) Treasure Cove! (The Learning Company) Treasure Mountain! (The Learning Company)
Writing	Basic Spelling Tricks (BrightStar/Sierra) Destination: Rain Forest (Edmark)

	Early Education - Early Spelling (SoftKey) Imagination Express Series (Edmark) Storybook Weaver Deluxe (The Learning Company) Ultimate Writing & Creativity Center (The Learning Company)
Fine Arts	Disney's Magic Artist (Disney Interactive) Early Education - Creativity Pak (SoftKey) Kid Pix Studio (Broderbund)
Music	Kid Riffs (IBM)
Health	Dr. Health'n steins Body Fun (Star Press Multimedia) Magic School Bus Xplores the Human Body (Microsoft) What is a Bellybutton? (B&N Software)
Mathematics	Awesome Animated Monster Maker Math (Houghton Mifflin Interactive) Bit-Bot's Math Voyage (Sanctuary Woods) Early Education - Math Basics (SoftKey) Early Learning Collection (Top Class/Compedia) Interactive Math Journey (The Learning Company) Math Blaster Episode 1 (Davidson) Mighty Math K-1-2 and 4-5-6 (Edmark) Montessori Math by Colors (Info Disc) Real World Math (Addison-Wesley) Snootz Math Trek (Theatrix) Treasure Math Storm! (The Learning Company) Troggle Trouble Math (Mecc)
Problem solving	Arthur's Teacher Trouble (Living Books) ODS Robot Challenge (Ohio Distinctive Software) Thinkin' Things 1 and 2 (Edmark)
Other Languages	All-in-one Language Tutor (Syracuse Language Systems)
Spanish	JumpStart Spanish (Knowledge Adventure) Lyric Language (Penton Overseas)
Physical Education	
Primary Language for Bilingual Education	
Science	A.D.A.M. The Inside Story (A.D.A.M. Software) Bus Adventure (Knowledge Adventure) Lost in Space Animated Learning Adventure (Sound Source Interactive) Ozzie's Science (Digital Impact) Sammy's Science House (Edmark) Thinkin' Science (Edmark) Treasure Galaxy! (The Learning Company) Welcome to Bodyland (IVI Publishing/C-T Interactive)
Animals	Oceans Below (Mindscape)
Social Studies	Discoverers (Knowledge Adventure) How Things Work in Busy Town (Paramount Interactive) Ozzié's Travels (Digital Impact) Yukon Trail (Mecc)
Geography	ODS Air Explorer (Geography) Where in the World is Carmen Sandiego? Junior Detective Edition (Broderbund) Yearn2Learn Snoopy's Geography (Image Smith)
Texas history	
United States history	Children's Atlas of the United States (Gametek)

Table 1: Elementary School Grades Curriculum Table

Middle School Course/Topic	**Software (Publisher)**
Middle School	Middle School Advantage – Mathematics, History, Science, Literature, Geography (Encore Software) Discover Science, Math, Geography, History, English (Arc Media) Windows Middle School Math and Grammer (Pro One/Sofsource)

Business	
Typing	Mavis Beacon Teaches Typing for Kids (Software Toolworks) Power Typing (Pro One/Sofsource) Typing (Expert Software) Typing Tutor 6 (Davidson)
Computer Literacy	Learning Collection - Learn about Computers (Top Class/Compedia)
English as a Second Language	Learn to Speak English (The Learning Company)
English Language Arts	Book Report (Pro One/Sofsource) Family Pack: Kids Can Read (Discis) Grammer Games (Davidson) Rockett's Adventure Maker (Purple Moon) Student Writing Center (The Learning Company) Student Writing and Research Center (The Learning Company) Ultimate Word Attack (Davidson) Windows Grammar 1 (Pro One/Sofsource) Writing Tutor (Simon & Schuster)
Fine Arts	Flying Colors (Davidson) The Multimedia Workshop (Davidson) ODS Amazing Art Corner (Ohio Distinctive Arts)
Health	Dr. Shueler's Self Health (Pixel Perfect) Learning Collection - Learn about the Human Body (Top Class/Compedia)
Mathematics	The Clue Finder's Math (The Learning Company) Countdown (Voyager) Learning Collection - Learning about Fractions (Top Class/Compedia) Math Blaster Episode 2 (Davidson) Math Blaster Mystery (Davidson) Math Master Pre-Algebra (Smart Works) Middle School Math (Pro One/Sofsource) ODS Carnival Math (Ohio Distinctive Arts) Pre-Algebra (Davidson) Super Solvers: Out Numbered! (The Learning Company) Windows Fractions Made Easy (Pro One/Sofsource)
Problem solving	Learning Collection - Advanced Thinking Games (Top Class/Compedia) Logic Quest (The Learning Company) Mission T.H.I.N.K. (The Learning Company) Strategy Challenges Collection 2 (Edmark)
Other Languages	Language Discovery (Applied Optical Media)
Physical Education	
Science	In the Company of Whales (Discovery Channel) Interfact Electricity and Magnetism (World Book) Isaac Asimov's Science Adventure II (Knowledge Adventure) Learning Collection - Learn about Astronomy (Top Class/Compedia) Operation Neptune (The Learning Company) Operation Watershed (National 4H Council) Planetary Taxi (Voyager) Science Sleuths Vol. 1 and Vol. 2 (Video Discovery) Super Solvers: Gizmos & Gadgets (The Learning Company) Widget Workshop (Maxis)
Computer science	Learning Collection - Learn about Computer Programming (Top Class/Compedia)
Social Studies	Amazon Trail (Mecc) Carmen Sandiego - Where in the World, U.S., and Time (Broderbund) The Cartoon History of Time (Putname New Media) Geosafari (Educational Insights Interactive) Ideas that Changed the World (Cambrix Publishing) Oregon Trail I and II (Mecc)
Geography	Georunner (Ohio Distinctive Software)
Texas History	
United States History	American History Explorer (Parsons Technology)
Vocational Education	Chruncher (Davidson) Dr. Shueler's Home Medical Advisor Pro (Pixel Perfect)

	Fun with Electronics (Cyber Crafts)

Table 2: Middle School Grades Curriculum Table

High School Course/Topic	**Software (Publisher)**
High School	High School Advantage Mathematics, History, Chemistry, Accounting, Language (Encore Software) The Princeton Review: High School, College Prep (The Learning Company) Super Tutor Chemistry, Geometry, Physics 1, Physics 2 (Dr. CD-ROM)
Business	Accounting Information Systems (Cybertext Publishing) GT Personal Accounting (GT Interactive Software) Principles of Finance: An Interactive Approach (South-Western College Publishing) Slam Dunk Typing (Creative Wonders)
Economics with Free Enterprise	Economics Alive! (South-Western College Publishing) Macroeconomics Principles and Applications (South-Western College Publishing)
English Language Arts	American Poetry of the Nineteenth Century (Voyager) English Master (Smart Works) Windows Grammar II, Term Paper, Vocabulary (Pro One)
Fine Arts	A Passion for Art (Corbis)
Health	How Your Body Works (Mindscape) Casualty Kid First Aid (Iris)
Mathematics	Math for the Real World (Knowledge Adventure) Math Master Algebra 1, Algebra 2, Geometry, Trig. (Smart Works) Math Workshop (Broderbund) Mathpert Algebra Assistant (Mathpert) Multimedia Math Achievement Pack (Simon & Schuster) The Princeton Review: Math Library (The Learning Company) Study Works for Math (MathSoft)
Pre-algebra	Math Heads (Theatrix) Multimedia PreAlgebra (Pro One Software)
Algebra I	Algebra CD (Expert Software) Astro Algebra (Edmark) AlgebraWorld (Cognitive Technologies Corp.) Math Baster Algebra (Davidson) Multimedia Algebra I (Pro One Software)
Word problems	WPS – Word Problem Solver (Brooks AFB)
Algebra II	Multimedia Algebra II (Pro One Software)
Geometry	Introduction to Geometry (Pro One Software) Multimedia Geometry (Pro One Software)
Trigonometry	Multimedia Trigonometry (Pro One Software)
Calculus	Multimedia Calculus I (Pro One Software)
Statistics	Stat Lady (Brooks AFB) Multimedia Probability & Statistics (Pro One Software)
Other Languages	Around the World: 30 Language Edition (Simon & Schuster)
	Complete System of Foreign Language Products (The Learning Company) Learn to Speak Spanish/French (The Learning Company) Quick and Easy Spanish (SoftBooks Media)
Physical Education	
Science	A Brief History of Time (BlasterWare) Beyond Planet Earth (Discovery Communications) Bodyworks 4.0 (SoftKey) Interactive General Chemistry (Falcon Software)

	Lab Bench (Peregrine Publishers) Orbits 3.0 (SoftKey) PCs in Space (Jackson and Tull) Science Master Biology, Chemistry, Physics 1, Physics 2 (Smart Works) The Way Things Work 2.0 (DK Multimedia) ZAP! (Edmark)
Computers	Professor for Microsoft Office (Individual Software)
Social Studies	500 Nations (Microsoft)
	Material World: A Global Family Portrait (StarPress Multimedia) Worlds Greatest Speeches (Softbit)
Texas history	
United States history	Encyclopedia of American History (Compton's New Media)

Table 3: High School Grades Curriculum Table

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Computer/Curriculum Integration Model and Teacher In-Service

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Abstract

In education there is a common concern that computers are not being integrated into the curriculum. This concern pervades the educational establishment from principals who want teachers to integrate computers into the curriculum to the Federal Government, which held meetings in the spring of 1998 in Washington to discuss the issue. The purpose of this study was to provide in-service training for teachers which taught the teachers who took part a Computer/Curriculum integration model and training in areas each grade group of teachers requested. Surveys were taken at the beginning of the study and at the end of the study. In addition, field notes were made during in-service activities.

Introduction

Integration of computer activities into the curriculum has become a major concern in the educational community. Some states, such as North Carolina are requiring those seeking licensure to pass computer competency tests and prepare portfolios. The Federal Government is also concerned about the issue as evidenced by a meeting held in the spring of 1998 to discuss possible ways to help teachers learn to integrate computer activities into the overall curriculum.

Some of the suggestions involved were providing teachers with models to follow when planning for computer/curriculum integration. Practical models for integration of computer activities into the curriculum need to be provided to teachers (Ehley, 1992). It is important to determine whether teachers find a model useful. The model we chose for this study is the ABCD model for computer/curriculum integration (Smith-Gratto & Blackburn, 1996).

The ABCD model involves four steps. The first step requires that teachers *Analyze* software to determine whether it addresses curriculum objectives or goals directly or can support them in some way. The analysis extends beyond a cursory look at objective matching to the appropriateness of the software for their students and itσ educational value. Once the software has been analyzed, teachers would *Brainstorm* a variety of activities for the computer and for classroom activities. The activities for the computer could involve an assortment of educational software types. The classroom activities should also encompass different types of classroom activities. After teachers have created a variety of activities they would *Compare* and the most appropriate computer and curriculum activities would be combined to meet the objectives of the lesson or unit. The next step would be *Defining* the objectives clearly and planning the sequence of the activities to meet those objectives.

Purpose of the Study

The purpose of this study was to examine how the introduction of the ABCD model of computer/curriculum integration and teacher requested training had on participants= attitude toward using computers in education and on their actual computer/curriculum integration. In addition, the participants in the study were asked to identify factors that they believed inhibited the use of computers to support the curriculum and how they perceived the accessibility of hardware and software.

Participants

The faculty and staff of a North Carolina public elementary school (P-5) participated in this pilot test of the ABCD Model. The school selected was the first to respond to a series of requests for participants. All teachers, student teachers, teacher assistants, and computer lab and media center personnel participated in this study (N=58). Of these participants, 46.55% completed both the initial and concluding questionnaires (n=27). The principal was supportive of the study and allowed teachers to take time for the training during the school day.

Method

In January, participants were given a written questionnaire that was used in previous studies and was adapted for use in this study (Breithaupt, 1997; Breithaupt & Wentworth, 1996). After completion of the first questionnaire participants were divided into grade groups, which consisted of 2 to 5 teachers. Each grade group received 1 $^1/_2$ to 2 hours of instruction explaining the ABCD model and how to use it. During the introduction of the ABCD model the faculty and staff were invited to set up individual or grade group training in any aspect of computer use. The administration at the school allowed release time from classes for training, but teachers scheduled minimal time for instruction. No teacher or group of teachers scheduled training for evenings or weekends. However, every grade group chose training on the Internet and received 2 to 3 hours of hands-on instruction on how to use browsers and search the World Wide Web. Several teachers requested written simplified instructions on how to use application software available at their school, but they did not request instruction on it or any other topic. In June, participants were given the same questionnaires in January but with modifications to include questions concerning the ABCD model.

Data Sources

The two surveys provided information on how the teachers used the computer in their teaching. A written questionnaire used in previous studies was adapted for use in this study (Breithaupt, 1997; Breithaupt & Wentworth, 1996). The questionnaire focused on four areas of computer use in education: (a) accessibility of hardware and software, (b) attitude toward using computers in education, 8 current computer use, and (d) factors inhibiting the use of computers to support the curriculum. A fifth area evaluating the ABCD Model was added to the questionnaires completed at the end of the study. In addition, notes were made about the training sessions and conversations with the teachers.

Results

During the instructional phase of the study teachers cited several things which concerned them. One concern expressed by several teachers involved time. These teachers said that they had difficulty finding the time to learn and practice using available software. Some of this group stated that planning and preparing to meet the school district and state requirements took a lot of time. The addition of examining software, learning how to use it, and planning to incorporate computer activities required time that they did not feel they had. A couple of the teachers stated that planning to incorporate the computer into regular lesson planning took more planning time than usual. Many also expressed concerns about meeting the State s mandated requirements and felt that computer activities could not help them meet the requirements. The questionnaires verified some of these observations.

Analysis of the responses on the initial and concluding questionnaires showed a significant increase on the attitude section

of the questionnaires ($F_{1, 52} = 17.17$, $p > .001$). There was no significant difference in the teacher =s use of computers ($F_{1, 52} = 0.78$, $p < 0.05$) or the factors inhibiting the use of computers ($F_{1, 52} = 0.04$, $p < 0.05$).

Table 1

Analysis of Variance for the Attitude, Use, and Inhibiting Factors of Using Computers in Curriculum

Source	Initial Mean	SD	Concluding Mean	SD	F	df	p
Attitude	2.96	0.30	3.53	0.64	17.17	1, 52	0.00
Use	1.52	0.50	1.67	0.73	0.78	1, 52	0.38
Inhibiting Factors	2.18	0.78	2.13	0.81	0.04	1.52	0.84

These statistics are supported by the comments made by the participants on the questionnaires. During the initial survey, the participants= comments on the attitude section reflected a general negative attitude toward using computers in their curriculum. For example, a fourth grade teacher A[Did] not know≅ whether there was software available for fourth grade or not. A reading specialist said AI teach reading. Technology [is] not a part [of it].≅ Finally, a Preschool Exceptional Child (learning disabled) teacher wrote that computer use Adoes not pertain to me.≅

The teachers listed a number of inhibiting factors on the initial survey. Responses ranged from AParents don t care (fourth grade teacher)≅ to ANot enough time to become comfortable with it[s] use (second grade teacher).≅ Several teachers also made comments on what they would like to see happen in their curriculum. A fourth grade teacher said that the students Awould love≅ access to e-mail. A resource teacher wrote AI need training and Help!≅

On the concluding survey, the participants= comments were much more positive. A second grade teacher reported using computers for the Areinforcement for concepts and skills.≅ The Preschool Exceptional Child teacher wrote about now having Aone game in my room the children are able to do and we use it every day.≅ The school art teacher acquired a computer during the study and reported plans to use it more this coming school year.

As the participants became more aware of available software, they indicated a need for increased accessibility. Most of the inhibiting factors cited on the concluding questionnaire revolved around the need for more up-to-date hardware and software. A kindergarten teacher complained that software was available, but not in her classroom where it would be more easily accessible to her students. One of the English as Second Language teachers has curriculum-relevant software for Macintosh, but only has access to a Windows platform in her classroom. The Preschool Exceptional Children teacher cited a need for more simple programs for the learning disabled students.

Continued computer instruction was also cited as a need. The second grade teachers requested step-by-step instructions on using some programs. Once other teachers became aware of the step-by-step procedures for the application software, many requested copies. A third grade teacher wrote ANeed training; time to implement the training ....≅ A fifth grade teacher also wrote ATime -- sufficient planning time is not provided.≅ The computer lab specialist summarized the problem with a report A... that teachers and staff don=t know much about computers.≅

Conclusion

With the increase in technology within our society, it has become a concern that students use the computer within their studies rather than as a separate content area. Ways to facilitate this have become important. We need to explore which

models help teachers and what kind of training programs would be most efficient.
This pilot study shows that even with minimal training time, teachers= attitudes toward computer use can be improved. In order to change teacher behavior toward integrating computers into the curriculum, it is essential to help teachers develop a more positive attitude toward computer use. There was no change in the teachers = use of computers, nor a reduction in the factors inhibiting the use of computers. However, several teachers reported making plans to incorporate computers more fully into their curriculum during the coming school year. Such changes in the actual use of computers may take some time. These changes must be preceded by a change in how teachers view computers, receipt of adequate computer training, access to appropriate hardware and software, and sufficient time to make learn, practice, and plan.

There were several changes the researchers would make to future studies. One change would be to have inservice training during periods of time when teachers are available during the school day, but not when they would normally be teaching. Since no teachers scheduled training for afternoons or Saturdays, it is believed that compensating them for taking their own time to learn how to use and integrate the computer might help motivate their participation. Rather than just introducing the ABCD model, we would include more time for teachers to use the model to develop lessons they would use in their curriculum and provide more guidance in the process.

Teacher training has been identified as a problem in the movement toward computer/curriculum integration (Willis, et. al., 1995 and OTA, 1995). Teacher responses to the survey and comments made during the training sessions indicate that the training and the time to practice were essential to their ability to incorporate the computer effectively. While attitudes were changed during the short duration of the training, the teacher behaviors were not. The results of this study suggest that teacher training be more formally scheduled and time allowed for teacher practice both computer skills and planning.

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Studying Technology as a Cohort: Teachers' Reflections on the Process

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Abstract: The journey toward professional growth, school reform, and an educational response to the challenge of technology integration is often a lonely one. One solution is to design professional development experiences for practicing teachers, particularly graduate study, that is organized around cohorts. Research has examined the outcomes of the cohort process, but it has not explored what features of the cohort process are reported as important in facilitating these outcomes. This article presents the results of a two round questionnaire to identify themes related to the impact of a cohort process. Based on the emergent themes, recommendations for capitalizing on the potentials of graduate study using a cohort process approach are discussed.

Introduction

The journey toward professional growth, school reform, and an educational response to the challenge of technology integration is often a lonely one. Even when teachers seek to confront the technology challenge and work toward changing and refining educational practice, peers, parents, and sometimes even students often view them as outsiders, non-conformists, and somehow "different." In the face of feelings of isolation or separateness, it is often easiest to return to more traditional practices. One solution is to design professional development experiences for practicing teachers, particularly graduate study, that is organized around cohorts. Structuring graduate study as a cohort process facilitates the formation of a group of students who share a common area of inquiry. Such a community of inquirers is bound by a common question. In this case, how is technology best integrated with the ongoing teaching/learning process? Starting at the same time and proceeding together over a period of time facilitates the development of a shared set of experiences, knowledge, readings, activities, and support systems. The graduate classroom becomes an organism rather than a sequence of meetings. Academic study within the frame of a cohort process supports the redefinition of roles where all participants become learners, students, and teachers (Norton, 1994).

The authors have worked with cohort groups of graduate students studying technology integration for the past six years. The program, referred to as the ITS (Integrating Technology in Schools) Program, is a four semester, cohort program. Groups of twenty-four to twenty-six students begin their studies together and proceed through the program as an intact group in a planned, systematic way (Norton, 1994). During the six years of the program, the authors have studied the outcomes of the ITS Program. Research on the program suggests that teachers shift their stages of concern from informational and personal to concerns relating to the consequences of technology for practice and collaboration (Norton & Sprague, 1996). Additionally, research suggests that participants in the cohort process increase their levels of confidence, change their teaching practice, and become more actively involved in school and district level technology decision-making (Norton & Sprague, 1996; Norton, 1995; Norton & Sprague, 1997).

Research such as this examines the outcomes of the cohort process. It does not, however, help understand what features of the cohort process are important in facilitating these outcomes nor assist faculty to design instruction that elaborates on these features. Neither does it reflect participants' own voices. What do participants find valuable about the cohort process? What aspects of the cohort process are problematic for participants? What attributes of cohort study do participants identify as different from their

previous learning experiences? What lessons for their own practice do participants draw from their cohort experience?

Studying the Cohort Process

During the Fall semester, 1997, applications were accepted for admissions to the 1998-1999 Integrating Technology in Schools (ITS) Cohort Program. University resources supported the creation of two cohort groups within the ITS Cohort Program. Fifty-one students were selected from the pool of applicants. These students met or exceeded the requirements for admission to the Graduate School of Education at George Mason University. Using geographical considerations, the selected applicants were divided into two groups. The first group of 25 participants was located in the central part of Northern Virginia or southern Maryland; the second group of 26 participants were located in the western part of Northern Virginia. Twenty-four percent of the participants were male; seventy-six percent were female. Years of teaching ranged from 2 to 26. Eighteen percent reported teaching less than five years. Thirty-six percent had taught between five and ten years. Eighteen percent reported eleven to fifteen years of experience. Twenty-seven percent reported more than fifteen years experience. Forty-nine percent of participants taught in the elementary grades; sixteen percent taught in grades 6 through 8; sixteen percent taught high school; and twenty-one percent served as technology resource teachers. The two groups met separately one night a week but participated in on-line activities as a whole group.

Toward the end of the second semester of the four semester cohort process, all participants were asked to write phrases in response to five, open-ended questions. Participants' responses were analyzed for common themes and tabulated as themes reoccurred. Thus, each phrase written by the first respondent to the first question was recorded on a separate sheet. Phrases written by the next respondent were analyzed for similarity to recorded phrases. If a phrase reflected a comment already recorded, a slash mark was placed by the recorded phrase. If each new phrase reflected no commonality with existing phrases, it was added to the list. Analysis continued in the same manner until all responses to the first question had been summarized in the list of recorded phrases. Questions 2 through 5 were treated in a similar manner.

Once the original questionnaire had been analyzed for common themes around each question, a second questionnaire was constructed. The second questionnaire summarized the themes that emerged for each question. This questionnaire was presented to the 51 cohort participants, and participants were asked to judge these five themes for accuracy in capturing their individual experiences as a cohort member. Additionally, each participant was asked to add any further comment they felt had been omitted by the analysis of previous comments. Added responses were analyzed in a manner similar to the analysis of the first questionnaire.

Participants' Reflections on the Cohort Process

First-Round Themes

Themes for the first round questionnaire are summarized in Table 1. Analysis of participants' responses to the first question revealed four central themes in response to the question: How is learning in a cohort program like ITS different from other learning experiences you have had? The most frequently mentioned differences between cohort learning and more traditional learning experiences focused on the theme of help and support that participants experienced with fellow cohort members. Phrases that reflected this theme included: "knowing and trusting each other," "everyone is in the same boat," "all in it together," "easier because the group can do more together than one," "support from others gives confidence," "relate to each others' frustrations," "building a relationship with members that continues throughout the program," "creates a bond from beginning to end," and "not such an isolated feeling when you are unsure of what is happening." The second most frequently mentioned theme for the first question was a sense of shared responsibility for learning. Comments reflecting this theme included: "peer learning," "sharing of ideas and experiences," "collaborative projects," "collaborative learning," "team work," and "you have to depend on others in your class much more than in other programs." The third theme focused around the development of shared knowledge, ideas, and expertise. Comments included: "not one person talking the

whole time," "opportunity to choose from a variety of perspectives," "deeper discussions/relationships with colleagues," "learning is extended and increased." "learned to appreciate the strengths of colleagues," and "more continuity/less fragmented course work." The fourth theme referred to a difference in the instructional approach used during the program. Comments included: "much more constructivist," "not just lecture and respond on paper," "more hands-on experiences," "internalizing information as opposed to memorizing," "relaxed, learner friendly environment," "less teacher directed," "instructors are facilitators," and "no exams – uses authentic assessment."

Interestingly, the themes that emerged in analyzing Question 2 – what are the positive aspects of learning in a cohort program like ITS – were similar to the themes that emerged from the analysis of Question 1. The most frequently mentioned theme to emerge from participants' responses was an emphasis on the development of interpersonal relationships with classmates and professors. Specifically, participants mentioned "building collaborative relationships," "developing a relationship with classmates," "giving each other moral support when feeling overwhelmed or stressed," "meeting new people and making new friends," "get to know your peers," "our friendships develop," "make valuable contacts," "help is just an email away," "easy access to professors," "feel like instructors really know me," "professors are supportive," and "can contact each other outside of class." The second most frequently mentioned theme focused on the building of shared knowledge, ideas, and expertise. Comments in this category included: "can answer questions for each other as we learn together," "see things from different perspectives," "easier expression of ideas due to knowing you are all on the same path," and "someone will ask the question I want to ask." The third theme to emerge centered on shared responsibility for learning. Comments included: "shared responsibility for projects," "everyone working together to achieve goals," "build on everyone's strengths," "better understanding of concepts," "material is relevant and can be applied to the profession," and "more input into the challenges we face." The final theme to emerge centered on the ways in which the structure of the program reflected participants' needs. Comments included: "more fun to come to class," "course is non threatening, and there is a relaxed environment," "shorter program," "time factor is great," "on site meeting places," and "positive feedback is immediate."

Question 3 of the study asked participants' to respond to the following question: What are the negative aspects of learning in a cohort program like ITS? Four themes emerged. The most frequently mentioned theme focused on difficult dynamics that occurred during group learning. Comments included: "some people complain a lot," "deadlines extended unnecessarily to accommodate some who are not organized or willing to work as hard," "individual accountability can affect lots of other people," "time constraints are difficult to deal with as everyone might not work at the same pace," "sometimes you work with people that don't work well with one's particular style," "knowing people too well can be distracting," "strong personalities tend to dictate the pace," and "some people perceived as not contributing on an equal basis bring down the group." The second theme centered on structural elements of the program. Comments included: "group study is a double-edged sword – move at a group pace with no real time to slow down," "difficult to do 2 or 3 classes a semester," "rigid structure regarding course load," "activities/group work do not leave time for in depth discussion," "too much reading," "a lot of outside work," "always having to be on my toes and do all the work," "program is intense," "not enough large group discussion," and "time is not flexible – can't join another section or skip a class until later." The third theme referred to individually felt pressures of belonging to a group. Comments included: "perhaps participants and instructors tire of each other," "no variation in group composition," "sometimes feel inferior to others who know more," "can't be an anonymous student," "times when you prefer to work alone," and "balancing work and family responsibilities have been difficult." It was interesting to note that 8 respondents stated there were no negatives.

Question 4 asked participants to respond to the question – What have you learned about yourself as a learner while participating in a cohort program like ITS? A total of 83 responses were written on the questionnaires. Twenty-eight (34%) of those responses were unique to the individual, and no themes were present. From the remaining 55 responses, three themes emerged. The most frequently mentioned theme focused on lessons for working with others. Comments included: "more creative when working with others," "like collaborative expressions of what we learned," "accomplish more as part of a group," "everybody must participate for a meaningful experience," "group work imposes discipline on completion of assignments," "do best when in a comfortable supportive environment with peers who have similar experiences," "two brains are better than one," "lose motivation if I think others aren't doing their share," "learned a great deal of patience in working with others," "difficult to give up control in group projects," "have trouble asking peers for help because I feel I am imposing," and "I can participate as a team member

and build my skills of compromise." The second theme to emerge from participants' responses centered on statements of new found personal efficacy. Comments included: "I can succeed in a program," "I can contribute in a class," "my opinion means something," "people do accept the answers I have," "my mind is opening up to new and wonderful ideas," "I am at least on par with other teachers in abilities, innovative ideas, etc.," "able to learn with support," "it's all right to depend on others," "I am capable of thinking and learning beyond my limits because I learn from others," and "I have more strengths than I thought I had." The third theme centered on individual participants' growing awareness of their learning style. Comments included: "I am a visual learner," "I learn by doing," "I dislike lectures," and "I am not an abstract thinker."

Question 5 asked participants to respond to the question – What are the three most important things you have learned about teaching while participating in a cohort program like ITS? A total of 114 responses were written on the questionnaires. Twenty-five (22%) of those responses were unique to the individual, and no themes were present. From the remaining 89 responses, four themes emerged. The most frequently mentioned theme focused on a variety of new teaching strategies. Comments included: "allowing more wait time for children to answer is crucial," "facilitating is better than instructing," "I've learned different approaches to teaching," "hands-on is key," "teachers need to let students construct their own learning," "use open-ended activities and processes to teach," "performance assessment," "assessment of student learning should be continual and come in many forms," "authentic assessment," "I learned inventive alternatives to review readings," "more active learning is better," "many different models have been shown/alternative strategies," "even when you find a new way to do things, there is always another new way," and "there are many more philosophies than I knew about." The second theme centered on the value of using group work for learning. Comments included: "group projects when done right can lead to greater learning," "encourage students to think and solve problems on their own," "allow students to work together and share ideas," "to allow my students to step back and take in the perspectives of others," "work with and as a team," "students can trust each other," "using group work is tricky," and "teachers can trust cooperative output." The third theme centered on strategies for using technology. Comments included: "many ideas for integrating technology/materials," "can use technology a lot more and in different ways than I have," "using technology to teach is so much more than just hardware and software," "teachers must feel comfortable with technology before using it with their own students," "integration is essential," "web based learning ideas," and "skills in using technology are not software oriented." The final theme focused on paying attention to students' learning styles. Comments included: "students learn best when offered different opportunities to learn," "variety is a necessity," "provide many opportunities for learning to take place," "students have multiple intelligences which must be considered," and "different learning styles must be addressed."

Second Round Responses

Themes from the first questionnaire were summarized for a second questionnaire. Students were asked to review the themes for each question and respond to two additional questions: 1.) Do these themes represent your basic response to the question and 2.) Are there any additional comments you would like to make about these themes? Forty-seven of the fifty-one participants completed the second questionnaire. On Question 1, 46 participants felt the four themes – receive help and support from fellow cohort members, shared responsibility for learning, shared knowledge/ideas/expertise, and alternative instructional approach – represented the differences between learning in a cohort and other learning experiences. Of the sixteen comments made, no new themes emerged. On Question 2, 46 participants felt the four themes – building interpresonal relationships with classmates, shared knowledge/ideas/expertise, shared responsibility for learning, and structure of the program – represented their perceptions of the positive aspects of learning in a cohort. Eleven additional comments were made, but no new themes emerged. On Question 3, 34 participants felt the three themes – difficulties with group dynamics, difficulties with Program structure, and individual concerns with group membership – represented their perceptions of the negative aspects of cohort learning. Eleven felt the themes did not represent their perceptions. The 28 additional comments indicated concern with the theme – difficulties with group dynamics. Participants felt that most of the stated negatives were not representative of their experience. Comments included: "themes 1 and 2 sound like whining," "I feel that the comments above are too negative with how I feel . . . there are ups and downs in any type of relationship," and "I find very little negatives with the cohort; I realize that it requires a lot of work in 16 months, however, it has been manageable when I kept myself organized." On Question 4, 46 participants felt that the three themes – learning to be a member of a group, new found personal efficacy,

and awareness of personal learning style – represented their sense of what they had learned about themselves as a learner while participating in a cohort program. Fifteen additional comments were made, but no new themes emerged. On Question 5, 45 participants felt that the four themes – new teaching strategies, using group work for learning, strategies for using technology, and attending to students' learning styles – represented the important things they had learned about teaching while participating in a cohort program. Eighteen additional comments revealed no new themes. Representative of the comments were the following two statements: " Wow! This page is right on the money" and "new teaching strategies and technology strategies have been the most beneficial for me."

Learning from the Cohort Participants

Previous research on the ITS Cohort Program (Norton & Sprague, 1996; Norton, 1995; Norton & Sprague, 1997) has demonstrated that participants in the Program shift their stages of concern from informational and personal to concerns relating to the consequences of technology for practice and collaboration with others as well as increase their levels of confidence, change their teaching practice, and become more actively involved in school and district level technology decision-making. While many factors associated with the Program, such as class readings, class assignments, class projects, and on-line activities, certainly influence these outcomes, cohort study is an integral part of the Program design. This study identified the attributes of cohort study that participants felt influenced their experience in the Program.

While the power of cohort study is clearly evident in the themes that emerged on the first questionnaire and were validated by the second questionnaire, two important considerations emerged concerning the use of cohort study as a structure for graduate programs. First, attention by faculty to the content to be studied is not sufficient. For students working together over four semesters, much attention must also be paid to group dynamics – not just in the group building phase at the beginning of the program but throughout. Working and profiting from study as a group can not be taken for granted. It must be continually nurtured and supported. Responses of participants indicated that small grouping for projects and class activities was sometimes problematic. During the group building process, faculty used random and varied strategies for grouping students in an attempt to get the group to know each other. As the semesters progressed, faculty relied more on self-selection of groups. Some participants felt that self-selecting group members was best while others expressed appreciation for random/varied assignment to groups. Those favoring self-selection of groups were concerned about having to work with "slackers" and the perception that some participants did not contribute as much or share interests and experiences similar enough to their own. Those favoring random/varied grouping strategies felt that interactions with more diverse class members contributed to their study. It seems that the use of both self-selected grouping and random/varied grouping should be used throughout the program as a group is not just built, it must be maintained. Like any relationship, the relationship of group members to others in the group needs ongoing attention. Perhaps the most effective strategy would be to use random/varied group assignments throughout the program for short-term activities and permit self-selected groupings for long-term or content/grade specific activities.

The second concern that emerged from participants' comments centered on perceptions that not all group members came to class equally well prepared or contributed equally to completion of projects and assignments. This concern is, perhaps, best expressed by the following comment written on a second round questionnaire: "I feel strongly that, unfortunately, one of the negatives of being in a cohort is that there are always going to be 'slackers.' I feel that there are people who never do their share with many group activities, and always seem to come out 'smelling like a rose.' Others put in twice as many hours doing our own work and the work of these others who are less apt to complete the work – and that isn't fair." Another student wrote: "As the program progresses, people learn how to work the system and do just enough to get by."

Faculty who teach in a cohort program must find ways that allow them to identify those who do not contribute equally to the completion of assignments. When systems of assessment evaluate the final product and assign grades to the group, there is no way to determine individual effort toward the group project. And, because the group identifies itself as a group and must work together over four semesters, there is a reluctance for students to identify those who are not contributing or to criticize each other. As one participant wrote: "I'm not sure we are as honest in giving feedback to each other because we know

each other well." Two solutions might be influential in addressing this problem. First, group projects and activities should be evaluated not only by rubrics or criteria that address the product but also by confidential rubrics that address the process – the contribution of individuals and the dynamics of interactions. Second, for projects and activities that will be graded, it is important to create a balance between those that are assigned individually and those that are assigned to be completed by a group.

Results from the two questionnaires also shed light on how the cohort structure of the program contributes to teacher change. The themes of shared responsibility for learning, building interpersonal relationships with classmates, help and support from group members, and shared knowledge/ideas/expertise that emerged in relation to both the first and second questions relate directly to the power of the cohort to support the difficult process of learning and changing. As one participant wrote on the second questionnaire: " shared responsibility for learning is the most important theme in the cohort program . . . it keeps the community of learners motivated to stick with it." Another participant wrote: "I enjoy being part of a group now. Amazing – I was the original lone ranger before this program started." Perhaps the power of these themes is best captured by three students who sent email messages about their reflections. One student wrote: "This whole program has really made me think in ways I never have. I would even say that I am learning to be a better thinker. I like being exposed to the new readings and I enjoy my discussion group. I also like working with so many different people." A second student wrote: "Working in a group truly brought out the best in everyone through a collaboration of ideas." A third student wrote: "I hope to 'bleed' the phenomenal resources in our class – classmates and instructors – as dry as I can. There is much to be learned from one another's journeys." In addition to the power of shared responsibility and learning as it impacted their own learning experiences, there was evidence from participants' comments that their experiences studying in a group translated to the ways in which they altered their practice. One comment read: "I have changed my classroom from individual learning to a more collaborative learning atmosphere, and the results have been surprising. Students like it, and I hear more pertinent discussions going on. The kids seem to get excited and prefer to bounce ideas off of one another."

Participants' reviews of the cohort structure of the ITS Program suggest that combining this structure with ongoing study about the ways in which technology can support K-12 teaching and learning facilitates change. Participants come to understand learning and educational change as a group effort that depends on shared responsibility, shared knowledge and vision, and the help and support of colleagues. They learn to work with peers, developing and pursuing common goals and alternating between leadership and supportive roles. They learn to cope with inequalities in expertise and effort. The process of working with and within a group support the development of the skills and dispositions necessary for educational change whether personal, professional, or institutional.

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Preparing Methods Instructors in the Integration of New Instructional Technologies into the Pre-service Curriculum

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Abstract: This paper describes the rationale, design, successes, and challenges realized during the Nebraska Educators' Summer Technology Training Institute (NESTTI). NESTTI is a training institute for Nebraska methods instructors in the integration of instructional technology, which was funded by the Eisenhower Professional Development Program in 1998-1999. The mission of NESTTI is to develop active learning and adventurous teaching strategies in methods instructors through the integration of new instructional technologies into the pre-service curriculum. The explicit goal of NESTTI is the improvement and reform of teacher preparation in Nebraska's schools of education. To accomplish this goal, methods instructors from 17 Nebraska schools of education were invited to participate in the year-long Institute. During the year, instructors were provided technology training, theory and examples of good practice involving instructional technology, and ongoing technical and pedagogical support as they redesigned their methods instruction and activities to integrate IT.

Educational reform calls for a new approach to learning and teaching that is often referred to as "student-centered" and "constructivist" learning. Karen Sheingold (1991) terms this new approach "active learning and adventurous teaching" (p. 19) because it effects the students' learning environment and it challenges schools and teachers to "give up long-held beliefs about teaching and learning and to devise instruction that embodies new goals and approaches" (p. 19). Moreover, Sheingold believes teachers must integrate technology effectively into their curriculum to support the active learning and adventurous teaching environment. Preservice education must provide an opportunity for future teachers to learn how to integrate new instructional technologies into their K-12 curriculum.

The importance of preparing future teachers to integrate technology has been addressed at the national level. The National Council for Accreditation of Teacher Education (NCATE) has adopted educational technology foundation standards for accreditation that were developed by the International Society for Technology in Education (ISTE). Teacher preparation programs seeking NCATE accreditation for certification or endorsement programs must document that students have an opportunity to achieve the educational technology foundation standards.

In order for students to achieve the ISTE standards, teaching with instructional technology must be modeled by methods instructors and practiced by their students. The Office of Technology Assessment state that "telling students about what is possible is not enough; they must see technology used by their instructors, observe uses of technological tools in classrooms, and practice teaching with technologies themselves if they are to use these tools effectively in their own teaching" (1995, p. 185). Therefore, pre-service methods instructors must learn how to use instructional technology in their own teaching as well as in their students' teaching of K-12 subject areas.

As Berge and Collins (1997) state it:

> Education professors do not have the luxury to choose whether they include technology as part of the course. If an expectation is to be made that all preservice teachers are proficient and knowledgeable in computers and networking technology, then it is imperative that these skills be modeled and taught by all education professors. (p. 21)

For instructors to model teaching with technology, they themselves must understand how to integrate technology effectively. Chris Dede (1998), from George Mason University, explains that schools must invest both in new instructional technologies as well as in professional development for educators: "Without substantial and extended professional development in the innovative models of teaching and learning that instructional technology makes affordable and sustainable, many educators will not use these devices to their full potential" (p 2).

Based on the reasons above, we decided to document how methods instructors across Nebraska were using instructional technologies in their methods courses and to determine the need for further training. In 1997, The Alumni Learning Technologies Center and the Center for Curriculum & Instruction, UNL Teachers College, sent a survey to 214 full and part-time methods instructors at six public and 10 private teacher preparation programs in Nebraska. Ninety-nine methods instructors responded to the survey. The data reveals that while most Nebraska methods instructors use some form of instructional technology, these instructors need to incorporate additional forms of technology into their teaching and into their students' teaching. Furthermore, these instructors need to achieve a higher level of technology integration in their curriculum.

We received funding from the Eisenhower Professional Development Program to create a one-year institute called the Nebraska Educators' Summer Technology Training Institute (NESTTI). The goal of NESTTI is for Nebraska methods instructors to develop "active learning and adventurous teaching" strategies through the integration of new instructional technologies into the preservice curriculum. These educators were targeted because they provide direct pre-service training for teachers in the K-12 areas of math, science, foreign language, social studies, and English/language arts.

NESTTI began in May 1998. Twenty methods instructors from nine schools of education in Nebraska attended a one-week training session. During this week, methods instructors currently using instructional technology shared their experiences, K-12 teachers modeled how they integrate new instructional technologies in their subject areas, workshops were taught on how to develop web pages and HyperStudio stacks, and the participants spent time developing projects. We offered an additional web page development workshop in August and an additional HyperStudio workshop in November.

The participants were given the charge that they must change either one part or more of their methods courses to include instructional technologies. Ideally, we hope the participants will model a lesson using instructional technology, then request students to develop a lesson which incorporates instructional technology, and provide an opportunity for the students to teach the lesson.

We continued communication throughout the year using a mail list. We will end the year with a follow-up meeting in May 1999. During this meeting the participants will share their successes and failures.

There have been a few challenges along the way. One, due to the timing of the one-week training session, a number of schools could not participate. Their spring semester had not ended and the faculty could not get away. Two, based on previous surveys, we had expected a higher level of comfort with instructional technology. The participants came at a variety of levels. A few participants wondered what the button on the mouse was used for. We had to quickly adjust for the lower skill levels. Three, there were a few participants who were required to attend by their dean. These participants did not come willingly. They were openly disgruntled. During one presentation at the beginning of the week, several of the participants were rude, talking and laughing during the presentation. Finally, one participant blurted "this is like learning calculus before learning algebra." Needless to say, we were worried that the participants would declare mutiny just four days before Dr. Linda Roberts would be visiting the Institute.

But, fortunately, there is a happy ending. The participants, who complained the loudest at the beginning, ended the week as our loudest choir members. These faculty members jumped in and came out swimming. All the participants left with a project started that they could complete during the summer and use in the fall. The final study will not occur until May 1999 to determine if the participants changed the way they teach by integrating new instructional technologies. We predict that all of the participants will have incorporated instructional technology at some level, ranging from posting the syllabus on the web to developing interactive lessons distributed on the web.

We have submitted another Eisenhower grant to continue the project. If this proposal is accepted, we will invite 20 methods instructors and content specialists to participate in the one-year institute. The participants will attend a 2-week session to learn how to use a variety of instructional technologies that support teaching and learning. The 1998 participants will be invited to attend the second week of the session to collaborate with the 1999 participants. Throughout the rest of the year, both groups of participants will continue to modify their courses to integrate instructional technology. While we have not achieved the substantial changes we set out for, the participants have made significant progress. It will take an investment of time on the faculty member's part and money from their school of education to really make a difference.

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Rewards and Regrets: An On-line Technology in Education Master's Degree Program

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Abstract: This paper focuses on the rewards and pitfalls of offering an on-line Technology in Education program. The program structure, administrative support needs, student readiness issues, evaluation process, student benefits and concerns, logistics, technical needs, and teaching issues relating to offering an on-line program are presented. Concrete examples from a graduate level class titled *Technology and Special Needs* will be discussed including assignments, responding to and tracking assignments, accessing readings, providing equipment, web resources and on-line conferencing.

Teachers' time is in short supply thus earning a master's degree program which is offered in an on-line format may be just what a motivated adult learner needs. Lesley College offers an 11 course on-line master's degree program in Technology in Education in three formats:

1. Traditional on campus full semester format
2. Intensive weekend format
3. On-line format

All three programs have their foundation in Lesley's Technology in Education program which was one of the first such programs in the country, providing leadership in the field and has evolved over the past 15 years.

Cohort Groups

We have found that one of the strengths of the off campus intensive weekend format is the bond and positive learning environment created by students enrolled in the program as a cohort. In the cohort model students are able to learn a great deal from each other and create a community of learners that often extends beyond the master's degree program. Based on experience with the cohort model, on-line students are encouraged to enroll in the on-line program as part of a cohort group. In the cohort group students get to know each other on-line by working on projects together, reading each others assignments and by exchanging information about the part of the world in which they live.

Whether joining with a cohort or not, students who enroll in the on-line program may earn a master's degree in Technology in Education. Those who join a cohort group may complete their degree in two years by taking two classes per semester for 5 semesters and one class in the final semester. Other students chose to take fewer classes per semester or skip the summer semester and earn the degree at a slower pace.

Application Process

To enroll in the on-line program, students need to submit and follow standard Lesley College Graduate School application procedures. In addition they are required to take an on-line readiness survey which is currently posted on the web at http://www.lesley.edu/online_learning/readiness/home.html

The readiness survey helps to insure that students have the requisite equipment necessary to complete assignments, the predisposition and schedule to enroll in an on-line program and technical skills including web navigation, email and conferencing capabilities. We ask students to reflect on these requirements before they

actually enroll in any of the on-line class. This allows students, in part, to self-select whether or not the on-line format is a feasible learning model.

Administrative Supports

To serve students effectively the program requires administrative supports which include a director, a program assistant and ideally an individual to provide technical support for hard to solve problems for both faculty and students. A budget for hardware, software and copying is needed as well as shipping costs to cover the cost of sending materials to students. Most materials are sent to students by courier service which allows the administrative staff to track materials easily if they are lost in transit.

On-line Program Benefits

The Lesley College On-line web page summarizes some of the advantages of enrolling in an on-line program. The benefits of an on-line program are numerous. Students have more flexibility over when and where work is done, learn about technology by using technology, and are given the freedom to pursue their own ideas independently. Groups of students interact and establish a community of learners in what turns out to be thought-provoking on-line discussions held in both small and large group formats. Since there are no location constraints, students work with colleagues from many locations which helps to broaden their view as to how technology is used in many different types of educational settings. The on-line courses offer a student-centered structure with the faculty member acting as a facilitator, allowing students to guide their own learning.

Based on Lesley College's nationwide and now worldwide reputation, students have the opportunity to work with educators and others from around the world who have similar interests. This interaction enriches the learning experience by providing the opportunity to learn from faculty as well as from colleagues. Being able to compare and contrast ideas and technology implementation from around the world enhances student skills and perspectives. (Lesley College, 1998)

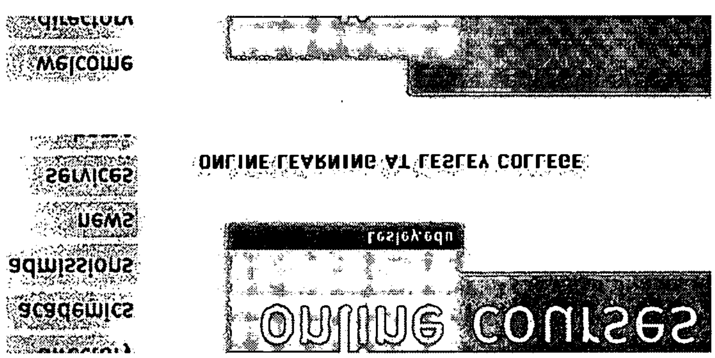

Figure 1: Lesley online course web page

On-line Program Student Concerns

From evaluations and feedback from students, we have learned about some of the difficulties that enrolling in an on-line program present. Students expressed a variety of concerns about being enrolled in an on-line program. The amount of email is often daunting since all of the "classroom" interaction takes place on-line. Students are dependent on technology For example, if they lose their Internet Service Provider (ISP), students have difficulty keeping up with their course assignments. The difference between a face to face class and an on-line class becomes apparent in terms of feedback for students. Due to the volume of written material feedback from

the instructor can be delayed by a few days and of course there are no visual cues to reassure students that they are on the right track. (Yoder, Ferris, & Thormann, 1998)

Student Evaluations

At the end of each course students electronically submit an evaluation that is sent out and collected by administrative staff. After processing the evaluations, administrative staff pass evaluations on to the program director and instructor. This staff member insures anonominity by removing the student's name from all evaluation before they are passed on to faculty. In addition, evaluations are only given to faculty after course grades are submitted. These evaluations have proved invaluable in helping to make the on-line program more viable and work better for the students and faculty.

Technology and Special Needs On-line Course

The *Technology and Special Needs* class offers students the opportunity to think about, and have experience with use of technology to benefit students with special needs. Students enrolled in the on-line program are given assignments that are to be completed within a one or two week period. All completed assignments are posted on a password protected bulletin board area on Lesley College's web server.

Class Interactions

As part of their course work students are asked to read and comment on each others assignments. Students and faculty select an alias screen name and register the name with a campus support staff person. In this way, the course content is discussed and students have the opportunity to interact. The aliases allow discussion participants, and particularly faculty, to comment on what has been posted without the reader being biased by the comment-writer's status or background.

Class Assignments and Readings

The assignments were developed to provide variety in learning approaches. The formats include individual, paired, and small and large group assignments. Readings are assigned for most assignments and are required to be referenced. Most readings are web based either through URLs or full text articles from databases that Lesley College has a license to use. A few readings that are useful and are not available on the web are sent via mail to students. There is also a required text book which students may purchase from Amazon.com or any other text book vendor. Some assignments involve web based research and readings not listed in the on-line syllabus.

Introduction Assignment

For one of the first week's assignment the students are asked to introduce themselves and also to reflect on their own experiences with students or individuals with special needs and share this on class bulletin board area. Students are required to read these introductions and interact with classmates about their experiences.

Specifically they are asked to identify the two individuals in class whose last name comes alphabetically before and after their last name. Students are to ask a question about what their classmates wrote in their introduction assignment and to respond to questions they are asked by classmates. This activity serves as an ice breaker for the students thus, they use their real names rather than an alias. The introduction is an example of one of the activities in which we ask students to interact with each other.

Small and Large Group Assignments

Another example of a class assignment involves selecting and working with a partner to investigate a disability area to discover how technology is used to support the learning of students who have a particular disability. In addition, a large group assignment is given in which the class is divided in half. They select roles based on cooperative learning principles. The roles include the following:

a. Team Leader will coordinate roles and tasks and lead the discussion to develop a list of common illnesses and guide discussions using some of the suggestions in the LISC activity.

b. Team Analyzer will collect all the data and develop categories.

c. Team Recorder will create a spreadsheet or database file and enter the data.

d. Team Synthesizer will analyze the data after it has been entered in the spreadsheet or database

e. Team Reporter will write a report about the data and send it to the other

f. Team Responder will receive the other team's report and respond to it

g. Team Checker will make sure that people have submitted all the information they need and make sure information is being shared as the activity proceeds

h. Team Visionary will help team members examine the data in other ways and help establish timelines.

In this role-based assignment students work cooperatively to collect data for an activity that is drawn from the curriculum, *Literacy in a Science Context*, (Grant, Storeyguard, Thormann & Weir, 1996) developed at TERC in Cambridge, MA and published by ASCD. *Literacy in a Science Context* is a technology-based human physiology curriculum designed for an inclusive classroom environment. Once students collect the data, they need to organize it, analyze it, write a report, exchange the data with the other half of the class and then respond to the report from the other class. This activity gives on-line students the opportunity to not only read about technology based inclusive activity but experience it.

Online Guest Speaker

To add further variety to the on-line format, we have students interact with a "guest speaker" who has a disability and uses technology to assist him in his work and private life. This activity helps students understand how technology can help an individual with special needs. To complete this assignment the student must ask at least one question and read all the other questions from their classmates and answers from the guest speaker. The students email their questions to the guest speaker and the entire class via email using an address book. The guest speaker responds to the question using the address book so that everyone builds and learns from the questions asked and the guest speaker's answer. Students are required to read all the questions and answers so that when they ask a question it addresses a new areas for everyone involved in the conversation.

Individual Assignments

The students are also asked to work on projects independently which involves conducting a case study and investigating and writing a report on a topic related to technology and special needs. To complete assignments students read web based articles and web resources identified by the instructor and those identified by the students. The class web page contains links to many of the on-line articles and other web resources. http://www.lesley.edu/faculty/thormann/spedonl.htm

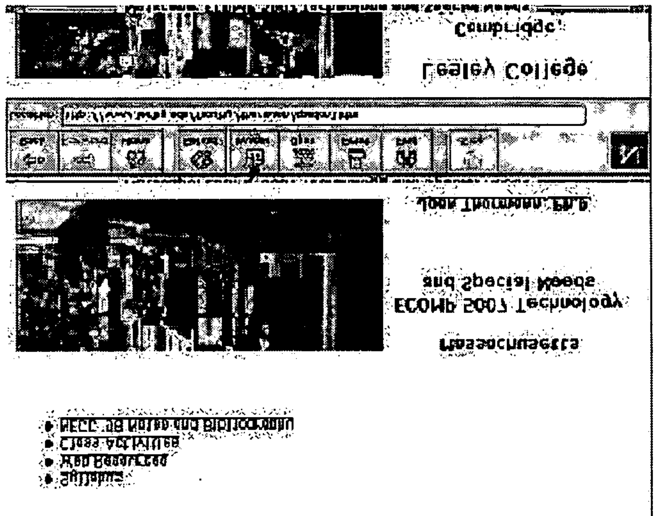

Figure 2: Technology and Special Needs Web Site

Assignment Check List

To help inform students that we have received their assignments we post an assignment check list on the web. After each assignment is read and accepted an "X" is put in the student's column to indicate that the assignment has been accepted. If student assignments are unacceptable the faculty member sends an email message with an option for the student to redo the assignment with specific directions for changing the content of the assignment.

Figure 3: Assignment Check List

Conclusion

The *Technology and Special Needs* course has been offered twice, summer and fall of 1998. We are constantly refining the course and thinking up new assignments and interactions. Thus far, students and faculty have had a successful experience with this course. The students who have enrolled in the program as part of the cohort seem to have benefited, in part because they are self directed learners and the program is designed for independent learners. The first cohort of students will graduate in the spring of 1999. We plan to have an elaborate on-line graduation celebration for these students.

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Integrated Multi-discipline Thematic Units in a Secondary School: A Challenge Grant Progress Report

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Abstract: This paper will focus on multi-disciplined integrated units as developed and taught by teachers from the Ainsworth Public Schools, a small Nebraska school district who are involved in a federal grant. The impact of the changes made in this schools district has not only been positive on students learning, but also the teachers, school, and community seem to be enjoying new-found interest in helping kids learn in new ways. In addition, the grant evaluators, college of education professors, use the projects as examples in their undergraduate and graduate education courses.

Introduction

Technology infused multi-disciplined integrated units developed and taught by teachers from the Ainsworth Public Schools, a small Nebraska school district, have shown positive results. These innovative units have resulted from the activities of a federal challenge grant, "The Connections Project; Strengthening Learning Through Technology-Based Integrated Curriculum and Professional Development." This grant is a $5 million U.S. Department of Education Technology Innovation Challenge Grant that includes four Nebraska school districts, as well as two adjudicated youth centers as lead sites, and is designed to improve student learning through effective teaching that includes technology-integrated curricula reflecting state curriculum frameworks based on Goals 2000 and national standards. In addition, special focus is given to high risk students, as well as developing partnerships among educators, business, agriculture, industry, and parents.

The grant evaluation team is from the University of Nebraska at Omaha College of Education Office of Internet Studies. The process of change used in this grant is important to teacher education, as all learn from the successes of P-12 schools and teachers. The professors on the evaluation team use the ideas and examples in their own lesson plans for both undergraduate and graduate teacher education classes. Connecting the teacher preparation curriculum to exemplary P-12 practices has shown to be very important to effective college teaching.

Integrated multi-disciplined thematic units is defined as teachers working together on the planning and implementing of instruction which focus on universal themes and concepts. Its philosophy is based on the belief that students are more motivated to learn through stimulating experiences and relevance to learners' experiences (Burns, 1994). Integrated multi-disciplined thematic units is not a relatively new concept and gained popularity in the 1920s with the establishment of the Social Science Research Council, which promoted collaboration regarding methods of instruction and assessment and shared educational knowledge across disciplines. The Cold War helped end the popularity of this teaching philosophy as it was believed that this typed of learning was not beneficial for members of an industrial society. However, with the advent of the information age and with the United States no longer being an industrial society, students are now are given more opportunities to learn through a variety of methods. Integrated multi-disciplined thematic learning is once again gaining popularity.

Today, although relatively few studies indicate multi-disciplined thematic units as a better teaching method than others, schools across the country at all levels are starting to incorporate this method of teaching. It is not uncommon to walk into a classroom and see English, social studies and technology teachers working together to

teach a unit on the Civil War or, as in the case of Ainsworth, Nebraska teachers, working together to teach math, science and English or English, history, art and consumer science.

The Grant Activities at Ainsworth

Twelve teachers from Ainsworth Public School, Ainsworth, Nebraska, were involved in the "Connections Project" for the 1997-1998 school year. They all have made commitments to their students to integrate curriculum and technology into their daily lesson plans. The teachers' primary focus is improving student learning. Through the integrated projects, teachers feel the students' retention of knowledge and skills is better because the learning and subject matter is reinforced in all classes. These thematic units varied from project to project and most included several disciplines and several teachers. Middle and high school students were exposed to old information presented in a new way.

Four Integrated Units

Colonial Unit

The Colonial Unit tied together English, Chemistry, AlgebraII and American History for the juniors during the fall semester. The unit was an integrated project using the Colonial period of American history as a focal point. Students spent six weeks studying this period in American History class and read "The Scarlet Letter" by Nathaniel Hawthorne and "The Crucible" by Arthur Miller in English class. In the culminating project for the study on colonial America, students were asked to think of Route U.S. 20, which goes through Ainsworth, and imagine taking it all the way back east, going back in time as they travel. There was a class discussion on the time period and the lives of some famous Americans, as well as the lives of common people. One activity was a role playing session, where students were placed in various domestic situations and they acted out how those situations would have been dealt with during Colonial times. Some of the situations students created were traveling to and planning a wedding, a family's barn burning, a witch trial, and a robbery of a general store. The students didn't use modern conveniences for their role plays. When the group of juniors planned the wedding, they spent time in chemistry learning how to make candles. Each one of the disciplines was incorporated as knowledge from all classes was needed for the finished project. On the sixth week of study, the students were divided into groups of three to five students. They were to create a colonial society, examples of which are: a family, giving each person a position in the family; a social group, such as a group of school friends; or a political group. They were to invent an authentic colonial situation that was accurate as to time, place, and nature of event, and then email someone who lives in the area that they were using for a setting in their presentation. On the final days of the unit, students made presentations on how they solved their colonial situation. They used the computer or a video presentation made on the computer to present their material. All students participated in the creation of this presentation, which was then given before their classmates. After listening to the discussion led by the teacher in English class, one student said, "Hey, this is the same thing we are learning in history class!"

Career Exploration

The Career Exploration unit investigated and developed an awareness regarding the importance of math, science and English in a variety of careers. Sophomores wrote a journal entry that asked them to prioritize their future career plans at that point in time and based on the results of the journal entry, the students were grouped according to interest. The students researched their interests beginning with suggested web sites and expanded in the directions their research took them. Final projects were PowerPoint presentations and a written essay and were counted as grades in Geometry, Biology and English II. Time was allowed in all classes for the work on the steps provided in the required components. In addition, the students completed a career exploration survey with the guidance counselor to determine possible future career options.

China

The China Project integrated the history of China with literature and culture. The courses involved were English II, World History, Art II, and Family and Consumer Science. The unit culminated in group multi-media presentations that shared the findings of the research, both from the Media Center and from computer sources, such as the web and email to experts. The students were grouped together in simulated Chinese families, with each one in a group assuming the identity of a family member with assigned individual responsibilities. One sophomore girl even bound her feet to better understand the life Chinese women. The unit was presented while the history students studied China and while they read "The Good Earth" in English II.

Rails to Trails

In the Rails to Trails project, all middle school subjects combined to explore the effect of the trails in north central Nebraska. Seventh graders studied the Cowboy Trail in northern Nebraska for approximately 4-6 weeks. The unit began with students preparing a survey about the Cowboy Trail for the community and publishing it in the local newspaper. People were asked to submit their answers to the school so the 7th graders could compile what the community actually knew about the local controversy. The next activity wasa study trip to the Cowboy Trail as a starting point for plant and insect identification, mapping and graphing, creative writing, and diorama creations. This encouraged the students' curiosity of the trail. All students were engaged throughout this unit by working on various projects independently, as well as cooperatively, in groups of three to four students, which were selected using the "wagon well" process. A final activity was a presentation by an expert on the Cowboy Trail. The students also created an Avid Cinema video which followed the unit from beginning to end. Many times during the course of the project, small groups were sent to the library for research, to the agriculture room for plant identification and mounting, and to other supervised rooms for computer work. The students were honored to be selected to present at the "Nebraska Rails to Trails Conference," The Nebraska School Board Association Conference, and many local events and functions.

These integrated units are just a small portion of the integration that occurs at Ainsworth Community Schools. This integration, as well as technology and increased teacher and student enthusiasm, has made the Connections Project a success for the school.

Results

As with any new innovation in education, analyzing the impact on students and teachers is important and usually difficult. It appears the project has been successful so far and the teachers and grant evaluators are continuing to learn from grant activites.

Students aren't the only ones benefiting from the integrated teaching. Teachers enjoy working with colleagues and learning from each other. Together, creative ideas are stimulated and they are able to capitalize on each other's strong points. Since the units and projects count for different grades in several classes, teachers are able to assign and assess more student generated work.

Although student impact is difficult to assess, teachers can easily see an improvement in student enthusiasm about school. Students enjoy working in groups and teaming skills are vital in the work world. While working with classmates and friends, students are developing their abilities to work in groups. One student said, "I like to work as a group. It helps you get to know people better that you wouldn't normally associate with and teaches you how to work with everyone--as a team. It also teaches responsibility on deadlines and holding up your part."

Students also prosper with the hands on learning in the units. Teachers use a variety of teaching methods which motivate students with different learning styles. While completing the different components of group projects, visual, auditory and kinesthetic learners all have a chance to thrive. The integrated projects have also had an impact on the time students spend in school and doing their school work. The students are successful and it is fun so they spend extra time on their projects. Teachers open the school on Saturdays and stay late in the evenings as they are popular times for students to work on projects.

One middle school teacher spends most of his spare time writing passes to the library for 8th period. This is only unusual because the middle school is on a seven period day and the students are flooding the Media Center after school. Any time of day, the Media Center is a busy place. Research for projects, papers, and assignments is common place. Students are becoming very familiar with the resources available in the Media Center. They not only check out books and magazines, they log on to e-mail, surf the web, order information via Electric Library, read Time on a CD ROM, and listen to French on a foreign language site.

Teachers see the Media Center as a focal point of the school. Teachers schedule a class in the computer lab months in advance. On most occasions, several classes are in the Media Center together sharing resources and technology.

But the effects of the Challenge Grant reach beyond the school doors. Parents are also impacted by grant activities of their students. During parent teacher conferences in the fall of 1997, a parent thanked a middle school social science teacher, for her teaching methods. The parent explained that normally on the 50 mile trip to the orthodontist, her daughter put on her head set and listened to music. But on the last trip, the daughter was excited about the Vietnam Challenge her class was doing on the Internet. They talked the whole way about the war and what the class was learning in social studies. The obvious benefit is that parents are becoming more involved in their child's learning. With active, supportive parents, students are receiving positive reinforcement at home as well as at school.

Summary

This U. S. Technology Innovation Challenge Grant, "The Connections Project," has begun to change the way teachers teach, the way students learn, and the way parents and the community view education. In addition, college of education professors are able to use these innovative units as examples in their education courses. The units described in this paper, as well as all Connections Project units are available at http://ois.unomaha.edu/connections/. As the project continues through the next few years, more and more units will be developed, teachers will continue to be trained, and student learning will continue to be impacted.

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Conversations about Teaching and Technology: A Support Group for Teacher Professional Development

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Abstract

Major political and societal forces are coming together to create an unprecedented push to infuse technology into K-12 schools. This infusion represents a serious challenge and an opportunity for teachers and researchers to better understand how technology is shaped by and shapes beliefs about teaching and learning. This study examines the relationships between teacher knowledge and beliefs about teaching, learning, and technology, and plans and talk about technology within a support group. The conversations we had as a group became a focal point for my analysis as I examined the content of these discussions, the social organization of the group, and changes in participation patterns over time. These patterns reveal changes in group leadership and conversational norms that allowed the teachers to engage in substantive pedagogical discussions, stimulated by talk about technology, and to negotiate group goals. The content of these conversations also reveals that these teachers' beliefs and knowledge of teaching and learning, along with their assumptions about student abilities and external pressures they feel, shape the plans they made for teaching with technology. This study provides evidence that a conversational forum for technology learning allows teachers opportunities to make public their taken-for-granted assumptions about teaching and learning, begin to examine these assumptions in a supportive social context, build confidence with technology, and ultimately take a more active role in school decision making related to technology adoption.

Introduction

This study (Topper, 1998) examined the relationship between teacher knowledge and beliefs and planned use of technology within the context of a technology-rich elementary school. I used access to a technology support group to investigate the nature of these relationships, through talk about technology, and the beliefs and experiences of the participating teachers as a window through which to examine these influences.

A technology support group provided an environment for supporting changing individual teacher beliefs about teaching and learning while also changing aspects of the school culture. This type of support group is also a model of professional development that is consistent with research on teacher learning and one way for teachers to develop the knowledge and skills necessary to take advantage of technology by supporting their long-term, sustainable professional development.

Through the experiences of the teachers who make up this support group, as reported by me, other teachers may see connections to their own situations and perspectives on teaching, learning and technology and insight from the stories these teachers tell about learning to use technology. I also hope that educators and administrators will see the benefit of this kind of professional development opportunity for teachers -- that is, participation in a dialogic group setting -- as an effective alternative to traditional forms of professional development.

Researcher Role

I view my role in this research as a guide or advisor (Apelman, 1986) to these teachers in their efforts to learn and develop new practices of teaching with technology. This research represents a chance for me to study K-5 teachers who are learning to use technology in a school setting within a supportive social context. Within this group, the learning and use of technology was self directed and grounded in these

teachers' specific classroom settings. I acted as a resource person, a guide, an advisor, and a facilitator for these teachers as they worked to incorporate technology into their teaching. I tried to facilitate the conversations and structure the group sessions to be supportive but challenging for the participants. Consistent with the work of Clark & Florio-Ruane (1983), I was a "critical friend" in the group encouraging these teachers to think and talk about their taken-for-granted assumptions. I also offered to help these teachers as they used technology in their classrooms and in the computer lab.

Participating in this group offered these teachers a chance to engage in authentic conversations about technology in the classroom and to construct their own meanings for technology in their teaching. Together, we explored how technology might be used in their classrooms, located any resources they need, addressed any problems they have, answered any questions, and in my dissertation I described their experiences as they learned about and used technology. I hoped that we could collectively construct a meaningful sense of the possibilities technology holds for the students in these teachers' classrooms.

I believe this kind of supportive social context is necessary for meaningful and sustained learning to take place around and through technology in the classroom. Teachers construct their own sense of what technology is, its' benefits, and how they plan to use it within the culture and context of their school by discussing it with their peers. My own assumption about educational technology is that it is another form of innovation, and as such should be critically examined by individual teachers. I hoped to help the teachers who participated in this study become knowledgeable consumers of educational technology so they could make their own choices about how to incorporate technology into their teaching. Effective professional development for teachers occurs when they are treated as professionals who make decisions every day about the pedagogical benefits of various teaching methods and curricular materials. The goal of a professional development effort should therefore be to help teachers make informed decisions and consider the consequences of their actions in the classroom.

The support group sessions were modeled after work I had already done at this school which initially involved bi-weekly sessions that lasted about 90-minutes and took place in a teachers' classroom after school around the computer. During these sessions, we explored and learned about whatever the teachers were interested in learning.

Research Questions

I developed a set of guiding research questions which, in the conventions of qualitative research, were modified as the study unfolded and I built grounded theory based on the constant comparison of data (Glaser & Strauss, 1967):

1. What do these teachers' believe and know about teaching, learning & technology?
2. How do these teachers' beliefs and knowledge about teaching and learning influence the sense they make of educational technology and their learning experiences around technology?
3. How do issues of teaching practice, pedagogy, and beliefs about teaching and learning surface in the conversations these teachers have around technology adoption?

Methods

I used an interpretive method of inquiry in this study where I described the experiences of the participating teachers and identified patterns of change and growth over time. While the principal lens for this analysis were the patterns of participation these teachers had in the discourse, this data was triangulated with my field notes, classroom observations, and participant interpretations.

Using transcripts of the group conversations, and analysis of interviews and field notes, I examined changes in the teacher talk over time focusing on topics introduced and patterns of participation. I examined how the discourse these teachers engaged in changed to see if these kind of conversations could move beyond simple technical discussions and towards substantive collegial interactions and collaborations that can be a more viable form of professional development for the teachers involved. The conversations these teachers

had around technology were a direct reflection of their thinking about technology in relation to teaching and learning so how these topics come up in their conversations shed some light on the ways these teachers were thinking about using technology in their own classrooms.

Specifically, I examined how discussion topics were introduced -- who introduced them, who picked up on them (uptake), who challenged a stated position, and how topics were changed -- as well as access to the conversational floor. This allowed me to examine the nature of the talk from the perspective of the form and function of the discourse.

Conversations represent one way for teachers to communicate about issues of importance and be exposed to critical ways of thinking through discourse. Conversations, triangulated with other data, also represent a tool for analyzing participation in discourse that has a directionality and academic purpose -- to provide opportunities for these teachers to identify their assumptions, consider the limitations of their beliefs, incorporate multiple perspectives into their conversations, and be clear about their reasoning and thinking.

These conversations also provided me as a researcher with access to how these teachers think about technology, teaching, and learning. The conversations, however, did not take place in a vacuum, but instead were influenced by a variety of factors, inside and outside the group itself. In order to understand how these conversations were viewed by the participants, I shared my observations with the participants and relied on an informant in the group.

The process I used during analysis was cyclical, where I started by identifying patterns in the data that I reported to my dissertation committee members. I regularly wrote analytic memos sharing my observations with my committee members at various points during the data collection period. My normal analysis process was as follows: I kept a reflective journal with notes and observations about our group sessions; as I listened to the audio tapes of each meeting, I developed a timeline selectively transcribing portions of the conversations I thought were interesting and connected to my ongoing analysis. As this process continued, I focused on different aspects of the conversations including power, authority, leadership, and strategies for managing access to the conversational floor.

From this initial analysis, I saw patterns emerge across group meetings that reflected the nature of the group discourse and individual patterns of participation in the conversations. I also observed changes in patterns of participation in the conversations over time as things changed inside and outside the group. The influences of the school culture, the district, and the community all played an important part in shaping the experiences of these teachers and I tried to understand how each teacher construed the situation they found themselves in during our meetings. My conclusions were drawn from my own interpretations of the data as a member of the support group.

From this second level of analysis, I developed some assertions which I later used to reexamine my data and re-coded it to reflect evidence to support or refute these assertions. As I listened again to the audio tapes, I noted statements or comments made during our meetings that were connected to these assertions. I soon found that three of the assertions related to the individual teachers in the group while the other three were connected to the discourse and changing patterns of participation in the discourse over time. These assertions later helped me shape the sense I made of the group, focusing on the individual teachers as well as on the context for their talk, and helped me understand the complex social interactions that these teachers engaged in inside and outside the support group.

Results

Talk about technology is contextualized in the wider school culture, especially external expectations placed on teachers. Introducing technology into a classroom brings with it external expectations of parents, administrators, and community members which in turn influence how teachers make sense of and use this technology. In many cases, discussions about technology evolve to include broader pedagogical and contextual issues that are influenced by a variety of external factors, such as administrative support, available resources, and district and community preferences. Teachers think and talk about these issues in ways that show they are connected in their minds.

Patterns of participation in teacher talk about technology are subject to influences from within and outside the support group. These factors not only shape what happens in the group, but the activities in the group also shape what happens in the larger school context, suggesting a reciprocal relationship between group and school activities. Conversational patterns are affected by personal and professional factors, such as evolving authority and leadership, and shape the ways in which members of the group participate in these conversations and the benefits they derive from this participation. Likewise, events that take place outside the group become fodor for conversation and collective action.

Talk about technology affords teachers opportunities to make public their own assumptions about teaching, learning, and technology. These conversations can provide a supportive setting for examining these assumptions as a form of professional development if the members of the group feel safe and the environment for conversation is non-threatening. Making their assumptions public, in a supportive social context, provides teachers with a chance to be critical of these assumptions and challenge their peers' assumptions in a professionally rewarding environment.

Teachers bring their existing beliefs and knowledge about teaching, learning, and technology to their interactions around and with technology. These beliefs and knowledge shape, and are shaped by, their learning about technology. Planning for technology will be reflective of teachers' assumptions about teaching, learning, student abilities, and external expectations, and planned activities will likely be consistent with their existing preferred modes of teaching.

These beliefs help teachers understand and make sense of their experiences with technology by constraining and affording ways of talking, thinking, and planning technology in their teaching. By learning about technology in a supportive social setting, some teachers may begin to question or examine their own taken-for-granted assumptions about teaching, learning, students, and technology. These opportunities represent perhaps the most significant aspect of this form of teacher professional development around technology adoption.

Much of the talk in the support group has been about "how" to use technology, especially focused on the practical issues of using technology in a classroom or lab, and less talk has been about "why" specific uses of technology might be beneficial for students. It seems that teachers' pedagogical decisions are implicit in their talk and actions and may even be hidden from their thinking. More time spent together might allow more group members to make public their beliefs and knowledge around talk of the pedagogical benefits of technology.

Significance

I believe this study is significant for a number of reasons. First, it represents an examination of the experiences of ordinary teachers who are struggling to make technology part of their teaching practices. These teachers have been provided with access to technology, in the form of classroom computers and a lab in the school, and have attended district-provided training session and receive technical support. The teachers in this study, while interested in learning more about computers, are not early adopters of educational technology. These teachers stories, more than any others represented in the literature, reflect the future of K-12 schools in so far as they give us a glimpse into what is possible for ordinary teachers to accomplish when technology is introduced into their classroom. The use of qualitative or ethnographic methods for understanding the experiences of these teachers also makes this study unique in the field. On a personal level, I wanted to work collaboratively with these teachers to support their efforts to learn about and use technology in their teaching.

In this study, I reported on the first nine months of our work together, even though the stories are still unfolding. Although this work has been informative, it is unfinished; there is still much to be done, making these results preliminary at best. Building a supportive social context for teacher learning is a long process, and even though we have made tremendous progress, I believe some of our best and most challenging work is yet to come. Keeping a group of professional teachers together over a long period of time has its own challenges, as there are often personnel changes within schools.

So this work represents a snapshot in time of the work we have done thus far, realizing that it is only part of the story -- the part I chose to tell and in my own words -- and that the story continues.

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The Research Of Using Different Teaching And Learning Strategies In Computer Courses For Inservice Education

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Abstract: The purpose of the study tried to understand the effect of using different technology-based facilities and materials in computer courses for inservice education. The teaching and learning process in computer courses included group discussion and self-learning. A computer broadcasting system was to use in computer classroom at the group discussion stage. A LCD projector and different assisted materials were used for inservice teachers learning at self-learning stage. I t is suggested that the way of using computer broadcasting system and a LCD project + work sheets + screen recording files is a potential way to help inservice teachers ' learning in computer courses.

Introduction

This paper describes the effect of using different teaching and learning strategies in computer courses for inservice education. The computer courses included the courses of how to using different software such as word processing, powerpoint, Frontpage98, and 3D-Studio to develop teaching and learning related materials. The teaching and learning strategies included using different models of technology-related facilities such as computer broadcasting system, a LCD projector, powerpoint display files, screen recording files to help inservice teachers learning in computer courses.

The computer broadcasting system is the system which a faculty can display his or her teaching screen from teacher's computer to all inservice teachers' computers. The LCD projector is the device that can project a computer screen to a large screen. The PowerPoint display files were the learning materials edited by PowerPoint software. The screen recording files were the learning materials edited by screen recording software.

Background

Learning computer software is ". . . conceptual in nature," involving an understanding of the concepts, principles of software commands, and ". . . procedural in nature," involving how to apply problem solving skills to solve a specific problem in software environment (Oliver, 1993, p. 299). The task of using computer software to solve problems requires the integration and implementation of complex cognitive processes. Thus, the design of computer instruction needs to be based on learning theories that suggest how a person cognitive processes are developed and operate (Anderson, 1983; Bitter & Lu, 1988; Cavaiani, 1989; Chesson, 1992).

Based on developments in learning theory, research on teaching and learning computer software suggests that effective instruction in computer courses should be aimed at improving students' mental model of computer concepts, overcoming students' inert knowledge, and developing students' metacognitive learning of computer software (Bayman & Mayer, 1988; Du Boulay, 1986; Galloway, 1990; Linn & Clancy, 1992; Joni & Soloway, 1986; Mayer, 1987; Pea, 1986; Perkins et al., 1986; Segal et al., 1992; Sleeman et al., 1986; Soloway et al., 1983; Volet and Lund, 1994).

Research on computer instruction also suggests that providing students with conceptual models of the computer environment will enhance their mental models in learning software (Bayman & Mayer, 1988; Mayer, 1987). To help students overcome their inert knowledge and develop their metacognitive

learning, Volet & Lund (1994) indicated that using problem-solving oriented instruction could enhanced student learning in computer software environment. By using problem-solving oriented instruction, it is important to offer students enough resource to encourage them meaningfully engaged in learning activities (Kearsley & Shneiderman, 1998). Thus, the potential of combining conceptual models and problem-solving oriented instruction needs be explored to improve computer instruction.

Method

The way the researchers tried to combine conceptual models and problem-solving oriented instruction is the teaching and learning process in computer courses. The teaching and learning process in computer courses included group discussion and self-learning. In group discussion, the faculty used computer broadcasting system step-by-step to discuss the course materials with inservice teachers. After that, inservice teachers used different learning models to learn software and did their exercises. Two main learning models were used in self-learning. The first model (see Tab. 1) was to connect a LCD project to a student computer as a learning sample, inservice teachers could learn software or do exercises with the sample computer if they want or by themselves. The other model (see Tab. 2) was self-learning without a sample LCD project. At self-learning stage, different assisted materials were provided to inservice teachers. The assisted materials included work sheets, work sheets + PowerPoint display files, work sheets + screen recording files. The work sheets explained how to complete the exercises step-by-step. The PowerPoint display files were to show how to do the exercises in PowerPoint format. The screen recording files were to demo how to do the exercises step-by-step in a real software situation.

Computer software	Group discussion	Self-learning	Self-learning	Self-learning
Microsoft Word	Computer broadcasting system	A LCD project + work sheets **Workshop 1**	A LCD project + work sheets + powerpoint display files **Workshop 2**	A LCD project + work sheets + screen recording files **Workshop 3**
Microsoft Powerpoint	Computer broadcasting system	A LCD project + work sheets **Workshop 1**	A LCD project + work sheets + powerpoint display files **Workshop 2**	A LCD project + work sheets + screen recording files **Workshop 3**
Microsoft Fontpage98	Computer broadcasting system	A LCD project + work sheets **Workshop 7**		A LCD project + work sheets + screen recording files **Workshop 8**
Autodesk 3D-studio R4	Computer broadcasting system	A LCD project + work sheets **Workshop 9**		A LCD project + work sheets + screen recording files **Workshop 10**

Tab. 1: Self-learning with a LCD projector

Computer software	Group discussion	Self-learning	Self-learning	Self-learning
Microsoft Word	Computer broadcasting system	No LCD project + work sheets **Workshop 4**	No LCD project + work sheets + powerpoint display files **Workshop 5**	No LCD project + work sheets + screen recording files **Workshop 6**
Microsoft Powerpoint	Computer broadcasting	No LCD project + work sheets	No LCD project + work sheets +	No LCD project + work sheets +

	system		powerpoint display files	screen recording files
		Workshop 4	**Workshop 5**	**Workshop 6**

Tab. 2: Self-learning without a LCD projector

10 workshops were held in The Institute for Secondary School Teachers in Taiwan (ISST) from 1997/9 to 1998/6. Each workshop consisted of 30 hours instruction and had four assignments over five days. The inservice teachers of the first three workshops (workshop 1,2, &3, called group A) learned Microsoft Word (14 hours) and PowerPoint (16 hours) with a LCD projector and different assisted materials. The other three workshops' (workshop 4,5, &6, called group B) teachers also learned Microsoft Word and PowerPoint but without a LCD projector. Finally, the last four workshops' teachers learned Microsoft frontpage98 (called group C) and Autodesk 3D-studion R4 (called group D) individually in a week schedule with a LCD projector and different assisted materials.

386 participants, 213 male teachers and 173 female teachers, came from 15 counties and 6 cities in the Province of Taiwan voluntarily registered to the workshops through their county or city educational bureau. The participants' assignments were evaluated by the instructors to mark completed or not completed in order to understand their learning performance. At the beginning of each workshop, the subjects completed a general background survey. At the end of each workshop, all subjects finished a learning survey to understand their preference of using which type of technology-based facility during their self-learning.

Result and Discussion

From the analysis of the general background survey, the subjects at group A & B were novice computer users. The participants of group C & D were experienced computer users (at least having the experience of using a computer software). From the analysis of the learning surveys of all workshops, it is found that every participant had very positive manner by using computer broadcasting system in group discussion. All subjects also indicated that work sheets were needed during self-learning. At the group A, 77 % of the inservice teachers regarded that the LCD projector was a very useful facility during self-learning. The completed rates of the assignments were .86, .88, .96, .81, .84, .95, .77, .82, .71, & .81 in workshop 1, 2, 3,4,5,6,7,8,9, & 10.

From the summary of the learning surveys and the discussion with the inservice teachers, the research found that using computer broadcasting system in computer classroom is a considerable teaching way because of its interactive and display capability. When compared with the assignment completed rates, it seems that the inservice teachers self-learning with a LCD projector had better learning performance than the inservice teachers self-learning without a LCD projector. When compared the effect of using different assisted materials, the inservice teachers learned with works sheets and screen recording files seems had the best learning performance. When compared to the complexity degree of using difficult computer skill to solve problems, the data from the discussion with the inservice teachers showed that the more complexity of computer skill needed to solve problems, the more screen recording files needed in self-learning.

Thus, it is suggested that using computer broadcasting system and a LCD project + work sheets + screen recording files is a potential way to help inservice teachers' learning in computer courses.

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Using CD-ROM Technology to Teach the Process of History

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1. Abstract

For a number of years, college instructors have been encouraged strongly to adopt computer-based technology into their curricula across various disciplines in order to alter favorably the learning environment and the education process. Many of these faculty have awaited eagerly the opportunity to embrace the latest innovations within the field and have been more circumscribed by the lack of enabling equipment/software than by their lack of computer-related knowledge or skills. In this paper we wish to present our immediate classroom experiences with and plans for incorporating student-created CD-ROMs into the teaching of a single course: Local and Georgia History. By this synthesis it is anticipated that students will perhaps learn more by doing and become increasingly motivated because of participatory learning. It is our secondary objective to use this successful project as an interactive multimedia (IMM) model which may be replicated in or at least transferred to similar college-level, high school or junior high school courses.

1. Introduction

For a number of years college and university teachers have been encouraged strongly to adopt computer-based technology into their curricula in order to alter favorably the learning environment and the education process. Many of the faculty, in various disciplines, have awaited eagerly the opportunity to embrace the latest of these innovations and have been more circumscribed by the lack of enabling equipment/software than by their lack of computer-related knowledge or skills. In this paper we wish to present our plans and findings for incorporating the employment of student-created CD-ROMs into the teaching of a single course: Local and Georgia History.

This Local/Georgia History team teaching project was intended to empower students to author the content of a compact disc (CD) through networked interactive multimedia as part of the course requirements. It was anticipated that students would perhaps learn more by doing and become increasingly motivated because of participatory learning (Lennon & Maurer 1994) and (Laurillard 1993). Our secondary objective was to use this successful project as an interactive multimedia model which might be replicated in or at least transferred to similar college-level courses. It was also planned that the student CD-ROMs would be used for assessment purposes.

With the combined course offering, students were assigned a family history project which would comprise a significant portion of the course grade for Local/Georgia History. At the beginning of the quarter, students were directed to bring in old and new family photographs, excerpts from diaries, legal documents, letters, newspaper clippings, etc., to scan into a computer. Furthermore, students were instructed in the methods of researching and writing a family history narrative. Student progress was monitored at intervals during the quarter. Selected contents of the student-created CD-ROMs will become part of the course content and its multimedia presentations as semesters progress. The Local/Georgia History course CD-ROM files will then be dynamic and divided into segments covering such topics as buildings of architectural significance, political events, modes of transportation, landscapes (forests, rivers, streams, farm land, etc.), scenes from area towns, industry, social gatherings, and hunting.

2. Classroom Methods

To provide students with the necessary computer skills in order to produce successfully a compact disc, Professor Troy V. Sullivan instructed our dual enrolled students in the use of Novell networked personal computers using NetWare (100 bit high speed network) supported by a Compaq Prolinea server using the Windows 95 operating system in his Computer Literacy course (CISM 1205). Students were taught also how to use the World Wide Web via the Internet accessed by Internet Explorer 4.0 software to download text, graphics, video and sound to aid their creations/recordings. These students also used Microsoft Word application software as their primary means of text input. Word topics covered in class included graphics, text boxes, templates, textart, and, of course, word processing for preparation of the family history narratives. They were also instructed in the manner one may employ that software while preparing term papers with appropriate documentation. Also included in the CISM 1205 course was the Microsoft Excel spreadsheet application so that students might create personalized graphs and charts. The students were further instructed in the use of a Scanmaker 3 flatbed 1200 dpi high-resolution scanner using Adobe PhotoShop software and, to explain certain parts of assignments, he used a ceiling-mounted Sharp LCD color projector in the microcomputer laboratory. They employed Microsoft Word software as their word processor and the Scanmaker scanner to input pictures and other text into their document files stored on one of the college's servers until the students were ready to prepare their compact discs. Adobe Premiere (Version 5) for Windows 95 authoring software recording to a Pinnacle Systems Miromotion DC 20 CD-ROM driver (Pinnacle Miromotion has video and audio capabilities) was used to create the individual CD's. Adobe Premiere would prepare the discs for writing by first testing the speed of the CD and then copying the selected files. Approximate creating times ranged averaged around ten minutes.

3. Conclusions

It is the intention of the participants in this project to adopt, on an ongoing basis, present and future-emerging computer-based and interactive multimedia technologies that are increasingly being embraced for academic instruction and active learning. For example, the writers, in May of 1998, received grants totaling over $38,000 through the University System of Georgia Teaching and Learning grants programs to upgrade equipment in one of the college's high-tech classrooms. On the twenty-four student workstations RAM was increased to 64 megs. A new instructor's workstation was purchased. It was a Compaq Deskpro EP with 64 megs of RAM, Pentium II 450 mhz, including a Superdisk LS 120 drive. Grant monies were also used to purchase Altiris Classview software to control the student's workstations from the instructor's computer. The planned structured student use of the Internet and the World Wide Web for online data retrieval and peer collaboration, as well as the development of a CD-ROM, will be part of the requirements of Local/Georgia History and will be added to the existing integration of PowerPoint assisted lectures.

It was comforting to discover that, during the semester in which we discussed and used the CD-ROM technology, these students demonstrated a hands-on knowledge of computers and their uses which should aid them in the future in many facets of their education and employment careers--which is, after all, what we within the profession are all about.

It is not the purpose of this history instructor to replace the lecture with courseware, however, the infusion of these and other techniques of today's computer-assisted learning into the regular presentation of academic content is beginning to alter significantly the technical learning environment while calling for the development within our institutions of a new infrastructure for "lecturing technology" in the "electronic classroom" (Brennecke, Schwolle & Selke 1997) and, (Lennon & Maurer 1994).

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Constructivist Methods for Technology Infusion in Mathematics and Science

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Abstract. This panel addresses the collaborative formation of a technology-focused teacher inservice professional development program for secondary science and mathematics teachers in Houston I.S.D. Project S.T.A.R. (Students and Teachers Achieving Results), funded by National Science Foundation, has evolved from a computer technology skills training with a "train-the-trainer" model, into a collaboratively developed multi-stage learning community. Panel members contributed to the current model in which technology has become instrument of instructional change, and not the content focus. Supported by a learning community of professors, project staff members, teacher-facilitators, and community resource persons, participant-teachers overcome the fears associated with working outside their comfort zone in a technology-rich, collaborative setting. Experiencing an equal mix of mathematics, science, and technology, participants working in mathematics and science teacher-pairs undergo unexpected positive changes in the way they view their role as a teacher.

Introduction

Project S.T.A.R. (STAR) was designed to encourage *all* mathematics and science teachers in H.I.S.D.'s sixty secondary schools to incorporate technology tools into their classrooms and participate in the collaborative development of shared quality lessons stored on a district-wide network. The initial "train-the-trainer" format consisting of 30-50 hours technology-tools training was later modified to seek more teacher-collaboration and classroom products. The early project and subsequent changes were described in a paper presentation at SITE-AACE 98 by Gaye Wunsch. STAR has two project goals: (1) combine the use of telecommunications with model classroom-based science and mathematics professional development and preservice teacher education; and (2) involve the teachers in the continued development of appropriate instructional assessment models using resources available on a district-wide network. These original project goals have not changed, but the educational and technological environment in which they are being realized continues to change dramatically.

Technology infusion projects typically struggle with the dynamic nature of technology itself. It is easy to be drawn into issues of hardware platform, software, and methodology of technological instruction, without addressing the more fundamental question of the role of technology in the delivery of public school classroom instruction. Instead of being a retrofit into the traditional classroom, technology has the opportunity to transform the way in which the educational community views the learning process and the management of our burgeoning knowledge base. Technology can place students closer to the source of their knowledge base: the people, events, and processes that shape new knowledge. A student is no longer limited by the static nature of textbooks that take at least three years to deliver "current events" to the classroom. Through e-mail, internet resources, and interactive media, students can interact with the world around them in a manner that can be very threatening to teachers who are accountable for maintaining control of the classroom and student outcomes.

Project STAR addresses this threat directly by *incrementally* placing the teacher-participants into a mathematics and science learning environment that thrives through technology. As adult learners, the inservice teachers who enter professional development training require certain individualized considerations for success. Throughout development of the pilot STAR coach model, the planning team has focused on maintaining a safe, nurturing environment for teachers to experience new ways to learn. Incrementally, the training program nudges participants through issues of self-efficacy and the vulnerability of saying, "I don't know the answer to that

question, but let's find out together." Teachers survive on "skinny branches" by forming a learning community based upon mutual trust and respect. The university professors offer credibility and positive role models to encourage veteran teachers to take personal risks. Teachers are intentionally placed in a three-way dynamic setting that depends upon a combination of mathematics, science, and technology skills and knowledge to assure both teacher comfort and challenge. Each participant feels some degree of comfort within his/her own content area as a secondary teacher, but may harbor misconceptions or lack of understanding of related current issues. They enter joint activities in each other's area(s) of content with little guilt in saying, "I don't know," because they are not responsible for that content as a teacher. However, with freedom to explore their learning in new ways, teachers reflectively gain new perspectives and mastery within their primary content, supported by the excitement and challenge of becoming confident with technology. The identified increments within the multi-year STAR coach training are described in the following two-part Table A-B.

Project STAR Multi-Year Inservice Teacher Professional Development Cycle for the Infusion of Technology Into Integrated Mathematics and Science Classroom Instruction

STAGES		PREPARATORY	STAGE I	
TEACHER ROLES		Self-examination	Teacher vulnerability as a learner, reflective practice.	
CONTENT and SKILLS	CURRICULUM	Learning styles, adult learner needs	M/S/T cross-content	M/S connections
	INTERACTION	Reflective writing, group dynamics	"Do-Talk-Do-Share" construct learning steps	Shared questioning process; feedback
	TECHNOLOGY	Needs assessment, hardware issues and arrangement of basic skills training	Calculators, CBL's, video/ graphics, scanners, digital cameras	Planning presentations, structuring delivery with multiple input
PROCESS		Contained, residential conference setting with self- and group-analysis	Professor-led M/S/T constructivist activities	Research questions and data collection
TIME FRAME		1½ -- 2½ days, 8:00 am –10:00 p.m., plus informal socialization	University-based Summer Institute (non-resident—Full days + open after-hours computer lab	
			3 – 4 days	3 days
DECISION MAKERS: LOCUS OF CONTROL		Project staff, teacher-trainers, teacher-facilitators, and professors.	Rotate M/S Professors	Teacher collaboration w/· facilitator-coaching
2nd YEAR COACH- TRAINER		Facilitator, organization role	Coach-on-the-side	Coach-facilitator

Table A: Entry-level Implementation of Project STAR Coach Model

STAGES (continued)		STAGE II	STAGE III	STAGE IV	STAGE V
TEACHER ROLES		Collaboration, integration	Professionalism, research practitioner	Reform, peer leader	Learning community implementation
CONTENT and SKILLS	CURRICULUM	External resources for M/S	Curriculum standards, content-consistentency	Classroom M/S integration	Student M/S integration
	INTERACTION	Team-building, conflict mgt.	Brainstorming, peer review, tuning protocols	Collaborative bonding, ongoing peer support	Summer/project investigations, self-directed learning
	TECHNOLOGY	Performance with technology, present-ation skills	Resources, integration of tools with curriculum	E-mail, internet, web & lesson development	Web-based student products, virtual field trip, group ware
PROCESS		Independent research on issues-based questions in community	Application of M/S and research techniques to HISD classroom instruction	Continue cross-connections and technology skills, campus leadership	Student enrichment and/or summer academy, with staff development
TIME FRAME		University-based Summer Institute (non-resident—Full days + open computer lab		Monthly contact for one-year minimum	2nd summer and/or school year, then ongoing leadership
		3 – 5 days	4 – 5 days		
DECISION MAKERS: LOCUS OF CONTROL		Peers, community mentors/resources	STAR trainers, professors, M/S pairs	Peers, trainers, professors, admin.	Shared community of learners
2nd YEAR COACH-TRAINER		Resource, coach, re-focus, question	Coach, clarify, challenge, encourage	Role model, reflective guide	Head learner, risk-taker, leadership

Table B: Incremental Stages of Teacher Growth in Project STAR Coach Model

The Project STAR conference panel discussion during SITE-AACE 99 will include persons who have experienced or produced portions of the five stages described in Table A-B. The project director, Gaye Wunsch, was an initial trainee in the original training format and the person responsible for redirecting the project. The project coordinator, Mable Humphrey, was a trainee in the 1997 pilot STAR coach training and coordinated a replication of this model at the University of Houston-Downtown in July 1998. University of Houston professors, Dr. Susan E. Williams (Mathematics Ed), Dr. John Ramsey (Science Ed), Dr. Sara McNeil (Instructional Technology Ed), and Dr. Bernard Robin (Instructional Technology Ed), contributed individually

and as a team in the planning and implementation of the STAR coach model. By March 1999, they will have updated information on their advanced technology graduate course being offered in spring 1999 to produce quality web-based integrated mathematics and science instructional units that maximize technological support tools. Mr. Harold Aiken, an environmental engineer with Montgomery Watson, has contributed to Project STAR through an active interest in representing the Houston area community of mathematics and science resources. His firm's major Houston area client, the City of Houston Water and Wastewater Department, strives to be a resource for education. Montgomery Watson staff members work with STAR teachers in several capacities, in a true learning community. Teacher-participants such as Della Sue Webb and Marie Levine demonstrate personal and professional growth in the classroom and within Project STAR, serving as 2nd year STAR coaches and trainers within the coach training program. The following detailed remarks highlight the perspectives and contributions from each category of panel members.

Project Director

Gaye Wunsch brought her experiences in the Coalition of Essential Schools as a Math/Science Fellow into Project STAR to facilitate a collaborative program that reflects the standards described in the Coalition's Ten Common Principles. The same care expressed by the Coalition in providing a climate for student learning is used to provide a climate for adult learning through Project STAR. The STAR training program begins with a weekend planning conference for participants and trainers to focus on their interpersonal skills and provide input on their learning needs and special interests. Motivational activities encourage the teachers to be a learner first, to take off their teacher-hat, and to go out on "skinny branches" to seek challenging goals. A climate of trust and professional respect is reinforced in small group visitations with university professors. Teachers leave the conference with a "can-do" attitude and a commitment to work together in challenging their comfort level.

The director has steadfastly maintained a focus on institutionalization of the goals in Project STAR. To strive for a critical mass of trained teachers, the participants who complete the fifteen-month STAR coach program are supported at their home campus and within their administrative district to provide ongoing professional development for fellow faculty members. The technology tools training is usually the first method of teacher-peer sharing by coaches, as a safer "content" to share than their subject-specific lessons. The methods used in the STAR technology-training model accommodate a range of learning styles and address individual needs. HISD's district-wide initiative to inform teachers about the Texas Essential Knowledge and Skills (TEKS) standards through its own objectives clarification project has served as a focal point for discussion of content and coordination with curriculum-based training.

The director, as a "head learner" and webmaster for the project, uses technology tools to communicate with and to inform participants, in order to encourage participant use of e-mail and the Internet. The project web site, http://www.houston.isd.tenet.edu/star, also keeps community resources abreast of project activities. Monthly face-to-face meetings with participants reinforce the personalization needed to share ideas and to provide motivational support during stressful times.

Project Coordinator

Mable Humphrey, Project STAR coordinator, provides a link between the classroom teacher's experience and the program development, especially in the mathematics connections. As a respected, experienced teacher and trainer, her willingness to explore new methods and share her own vulnerability with fellow teachers makes her a valued "head learner." Humphrey also models the tools of a STAR coach through her communication with teachers by e-mail. Her regular face-to-face visitations on local campuses remind administrators that their faculty members are interested in making substantive changes in their school's educational environment. Her visibility is testimony to STAR's commitment to a grass-roots approach instead of a top-down intervention program. She respects classroom teacher accountability to established standards and campus-based constraints as she monitors the program for manageable expectations that do not contradict external requirements.

HISD is a blend of site-based management at the campus level and district-wide initiatives involving all schools. Humphrey attends a variety of administrative and professional development programs to monitor consistency and maximum use of available resources. She also conducts training for administrators and teachers in settings outside of Project STAR. Her attention to detail and participation at all levels is key to the future of STAR's institutionalization following the end of this year's research.

Instructional Technology Professors

Bernard Robin and Sara McNeil introduced their Archive.edu Model as a potential tool to house the web-based lessons that Project STAR teachers produce. The organizational webbing session conducted by Robin and McNeil to assist students in planning their lesson is a favorite training exercise. The technology-focused training within the three-week summer STAR coach institute is progressively designed to parallel the mathematics and science content-based activities. During the first week, the professor-led portion is devoted to a survey of the most popular multi-media tools. Scanners and digital cameras were the favorites this past summer. Robin and McNeil are strong motivational leaders, pushing participants to begin sharing content and personalized knowledge as a means to becoming technically skilled. The early PowerPoint presentations during the second week indirectly open the content-based discussions as teachers strive to be succinct and clear in their delivery of information to each other about their investigations. Teachers bring back various data, photos, and other items from community resources and share with other teams through formal small-group presentations. The final week in the computer lab is open-ended, with teacher-trainers providing extra support for the professors as they facilitate the participants' more independently directed activities.

McNeil and Robin have modeled growth as "head learners" in providing instructional technology to inservice teachers who demonstrate a more heterogeneous mix of initial student skills than that encountered in the average university course setting. The inservice teacher-participants are not as motivated by the desire for grades and course credits, so new incentives based on peer pressure and the desire to be recognized were cultivated to encourage them to achieve results. McNeil and Robin have become passionate in their determination to make the technology tools become the methods of expression for the integrated mathematics and science products, and not the content focus. They draw upon their experience and facilitation skills to maximize participants' skills and available resources. The advanced technology course now being taught will closely document the key steps in the processes used by participants as they design instructional units to be shared as model collaborative products. The planning process for the course is an integrated development among at least five professors with different areas of expertise. The lessons learned during this project should have a beneficial effect on future coursework for preservice teachers and graduate students in university courses.

Mathematics and Science Education Professors

Susan Williams and John Ramsey each brought a strong background in teacher inservice training into Project STAR to assist the project, although they had not worked with each other in any joint projects. Their journey together as "head learners" has been an inspiration to the teacher-participants. Williams serves on the development team for the Mathematics TEKS Toolkit as a part of the Texas Statewide Systemic Initiative (TSSI). Ramsey works with student teachers in addition to his regular training program for Science-Technology-Society Issues and Solutions (Hungerford et al 1996) that nurtures the investigative approach to student learning. Ramsey is a strong proponent for constructivist student learning and has guided the project in maintaining a constructivist environment for the participants-as-learners. The project plan itself reflects his "Do-Talk-Do" philosophy.

The professors have evolved from an initially parallel, but separate, planning process into a more collaborative brainstorming method to draw upon each other's expertise. They attend each other's sessions and find that they complement each other's techniques. Williams has adopted a more constructivist approach, and Ramsey has found a new appreciation for the mathematical modeling in science. As they jointly counsel teacher-pairs in the

planning of instructional units, they continue to learn from each other. The participants have a strong respect for the professors' candor as learners themselves.

The professors are committed to a more active role in the technology portion of the teacher training, and will serve as curriculum consultants in the planned spring 1999 instructional technology course. Some of the professors' own work will be converted to a more technology-based format, reflecting connections to each other's content and to the TEKS. Williams' expertise with hand-held technology tools provided the early bridge into Ramsey's science-based lessons. The hand-held technology was also a key bridge for participants who were threatened by computer technology. Activities with graphing calculators, calculator-based-lab (CBL) tools, and related probeware gave participants in mathematics and science a common ground in which to share content and technology.

1997 Coach Participants

Della Sue Webb and Marie Levine were typical of participants who entered the program with mixed expectations. The modified approach used by Project STAR was not the norm for professional development in HISD, so the program was initially perceived as very ambiguous to consumers who were used to a more compressed, teacher-proofed set of products from inservice sessions. The initial planning conference helped them to view themselves as professionals with a role in teacher reform through technology. Technology-based tools and communication (project web site, e-mail, and shared lessons) continue to support coaches as they share their new skills and outlook with their home campus teachers. Development of instructional units to be published is viewed positively through continued professor contact and opportunities for presentation and facilitation within the project. Teachers benefit from the patience and flexibility provided through the program.

Early project products are in the process of being refined and transferred to the STAR web site. Project participants experience guilt and stress upon return to their campus when they find that they cannot make immediate wholesale changes in the way they do business as a teacher. They are helped to understand that some of their strongest contributions are in the change of attitude and work habits. An ethnographic study has been launched in an effort to capture case studies representative of the teacher transformation process.

HISD recognizes the new pool of teacher-leaders developing through STAR, and has plans to incorporate them in the implementation of its Urban Systemic Initiative for mathematics, science, and technology. Selected participants have already played key roles in the district-wide planning process. The facilitation, collaboration, and learner-centered skills that participants have acquired will serve them well as they assume a collaborative leadership role in the development of integrated mathematics and science at the campus level. STAR has intentionally cultivated the "early adopters" of the implementation curve to serve as interpreters between the front-line innovators and the middle group of teachers who appreciate guidance when experiencing change. The technology tools provide the means for communication and the source for new resources as teachers broaden their learning community.

Community Resource Persons

Project STAR arranged with various Houston area community resources to allow teachers, working in mathematics-science pairs or small teams, to spend approximately twenty hours conducting self-directed investigations into topics of personal interest that held potential opportunities for future classroom resources. In the summer of 1998, at least 370 hours of volunteer time by community resource persons was dedicated to sharing with teachers and providing tours and/or resource materials. The participants became investigative reporters for the full group as they described their experiences through PowerPoint presentations to each other. Business and institutional sources in the Houston area seek opportunities for outreach through education, but lack the effective means for accomplishing quality interaction with students. Through Project STAR they can provide a piece of their technical workplace instead of only funding support or volunteer work without regard to the nature of their business. Using teachers as their link to the classroom, the community resources engage teachers as the primary learners and allow them to choose the type of support that could be obtained from each

resource. The dialogues this past summer were very encouraging, as both sides of the discussion felt they benefited from the interactions.

The desire to communicate with these resources has further created an "attractive hazard" for teachers to acquire technology skills. A common interest in water studies is being developed into a Houston-Miami connection for investigative comparison of water-related issues. Six teachers from the Miami area participated in two weeks of the 1998 summer training. The communication between the Miami participants and Project STAR continues, with the director visiting them in Miami, and all of them remaining in contact with each other.

Harold Aiken has been a strong supporter of Project STAR's desire to cultivate communication links with the technical community. His firm recently led a Saturday morning inservice for a group of mathematics and science teachers who are just beginning to experience STAR activities at the administrative district level. They planned with STAR staff, HISD administrators, and STAR coaches to produce a morning "investigation" into flooding issues in the Houston area. The follow-up sessions will walk the teachers through the process of incorporating industry-based data and related materials into the classroom to bring relevance to skill-building classroom lessons. The environmental engineers are eagerly acquiring skills in instructional delivery by working with experienced teacher-presenters, and the teachers are excited about the direct application of classroom-required skills to the workplace. Engineers will mentor teachers via e-mail and web site products.

Again, HISD's recent Urban Systemic Initiative plans will use these early models of collaboration between business and education to engage a variety of community resources in meaningful support of education in mathematics, science, and technology. To follow the continued growth of Project STAR, the web site will serve as a central communication of products and training. Also, the Houston Urban Learning Initiatives in a Networked Community (HU-LINC) will be the future home of the institutionalized Project STAR. The HU-LINC web site is also under development and similarly linked to the HISD home page.

Concluding Comments

The stages of Project STAR described in Table A-B and supported by the panelists are still being refined. The 1999 Summer Institute will be fully documented in an effort to capture a clear description of this model for long-term professional development that embraces technology in a variety of ways. There will be other methods to accomplish the basic goals within Project STAR when attempts to replicate the project are located within another setting. The particular relationships between local universities and the school system in which the teacher-participants are employed will influence the working structures. Long term follow-up needs to look more like "teaching teachers how to plant the wheat" instead of "giving them loaves of bread" when teachers are asked to engage in the major changes that technology allows. Patience to help teachers manage their stress by incrementally absorbing new ideas will be necessary to ensure classroom implementation of newly learned methods. Teachers need to find or retain their self-dignity amidst major educational change, and they should always be treated as professionals. The content base for a teacher must allow for the infusion of new knowledge without teachers feeling inadequate. Technology should eventually change the way teachers conduct business, instead of remaining a stressful reminder of what they don't know. Allowing teachers the forum in which to construct their own version of a technological working environment will empower them to accept the challenges of technology in a positive way.

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All other references are directly linked to the web-based site described in the text.

INSTRUCTIONAL DESIGN

Interactive Literacy: A Forum for Thinking

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Abstract: The Explorers of the Universe is a scientific/literacy project involving middle, secondary, and postsecondary students in "real-life" self directed case-based investigations. This paper describes the school and societal curriculum, and the interactive literacy environments that these students use in planning, carrying-out, and finalizing their case-based research.

1. Introduction

This paper focuses on two issues in education that influence instruction and learning. One is how to establish interactive linkages between the school, university, and societal curriculum in promoting literacy and scientific inquiry by exploring the universe. The other issue deals with specific ways in which students create their own learning contexts when confronted with authentic problem-oriented tasks.

The primary goal of the Explorers of the Universe (http://coe2.tsuniv.edu/explorers) educational project is to involve middle and high school teachers and their students, and postsecondary students in a quality research program that is interdisciplinary rather than compartmentalized by domain (Alvarez, 1995, 1996a; Alvarez & Rodriguez, 1995). The focus is to engage students and their teachers in authentic tasks and materials couched in problem-oriented formats within meaningful learning contexts that foster thinking and learning. Authentic in that students construct meaning from real data and are asked to make sense of the world around them. Students pursue individual paths of inquiry using critical and imaginative thinking, and engage in social and solitary contexts that involve them in writing, intervening, and reflecting on ideas gleaned from conversations and readings (electronic and conventional). The process engages students in formal skills such as written communication, literacy, logic, and calculation.

2. Theoretical Framework

The science and literacy skills needed to learn, make connections within and among disciplines, and communicate to others are vital to learners who are expected to achieve educational goals espoused by the academies (e.g., American Association for the Advancement of Science, 1989; International Reading Association, 1992; National Science and Technology Council, 1995; Science Council of Canada, 1984; Royal Society, 1985). So, too, are the specific ways in which these learners use language and instructional tools, and technology for literacy learning and applying scientific and mathematical concepts (NASA's Education Program, 1993).

To promote a quality education plan that meets scientific, mathematical, literacy, and technology standards, we provide challenging opportunities for both teachers and students to think and construct knowledge generated in meaningful contexts. Students "showing" what they can do is a goal of this educational plan. This goal differs from those educational programs that are aimed at convergent projects, student-directed on-task modules, fixed curriculums, vast numbers of participants, and restricted standardized measures of assessments. Instead, the educational objective is to involve students in meaningful learning activities using self-directed cases, metacognitive tools (e.g., hierarchical concept maps, and interactive vee diagrams) to plan, carry-out, and finalize their research investigations, and an emergent educational curriculum plan that stimulates critical and imaginative thinking. The goal of this project is the enhancement of conceptual learning and application of written discourse and scientific inquiry across disciplines through an emergent curriculum using innovative technology.

If we expect critical and imaginative thinking to occur, we need to provide learners with problem-solving lessons in meaningful learning contexts. These learning contexts become meaningful when new information is linked to existing concepts, and when learned, become incorporated (integrated and related to other knowledge sources in memory) rather than remaining compartmentalized (isolated due to a lack of world knowledge and experience or due to rote memorization). This notion is consistent with Ausubel's (1968) theory of learning, Gowin's (1981) theory of educating, and Gragg's (1940) warning that "wisdom can't be told."

3. Melding the Societal and School Curricula

A unique aspect of this project is the melding of the societal and formal school curriculums. The societal curriculum is evidenced in not only what students bring to the classroom from their home, community, and religious environments, but also by involving the public in meaningful ways. Community resources (people and places), locally, nationally, and internationally become an integral part of the educational process. Throughout their case research, students are in contact with persons, state and federal agencies, archives, libraries, colleges/universities either directly or through electronic communications. Students conduct interviews with persons having pertinent information to their case study.

3.1 Project's Intent

Our aim is to make connections between students' societal environment and the formal in-school environment using self-directed cases and interactive technology, while simultaneously enabling students to discover for themselves learning contexts to deal with problem-oriented tasks. These societal and school factors are complex, interrelated and interactive entities that influence the education of students. Societal factors include that portion of a person's education acquired outside the formal classroom setting (see Cortes, 1981, 1986). It comprises the informal curriculum of home, neighborhood, community, and society that combine to educate each individual. School factors focus on informal in-school functions such as curriculum, school organization, counseling, assessment, teacher expectations, behavior, and so forth. Being aware of the sociocultural context in which students live help the teacher to make learning a meaningful connection between the classroom and the students' world environment (Alvarez, 1993). Our goal is for students to be immersed in problem-oriented tasks using authentic data that requires critical and imaginative thinking. The notion is for teachers and their students to incorporate their learning with academic subjects and make use of their informal and formal learning experiences.

4. Learning Contexts And Interactive Literacy Environments

Learning with technology is a vital component of this project. The ways in which students interact with each other via e-mail and share concept maps via the Internet; use the WWW to plan, carry-out, and finalize their self-directed case investigations on the Interactive Vee Diagram; and, publish their papers are important in defining learning contexts (Alvarez, 1998a,b,c, 1997a, 1996a,b). Learning contexts are defined as paths taken by students that extend and integrate a given discipline with other subject areas that cause enrichment with a target area of study (Alvarez, 1996a). As students learn and think with technology they pursue divergent paths of inquiry, and relate their formal school experiences to their informal out-of-school experiences. These paths provide multiple possibilities for resolution of their cases, and open areas for discussion that extend and integrate the discipline with other subject areas to enrich the learning environment.

A *CD Case Guide* has been developed to enable teachers and students to become acquainted and access points of uncertainty to reestablish their conceptual understanding with the metacognitive tools and case format required in preparing their case reports in the Explores of the Universe project (Alvarez, 1998b). This CD describes, narrates, and shows animations of concept maps and vee diagrams, video clips of teachers and students discussing these metacogntive tools, an Action Research Strategy, a Notebook that allows students to correspond directly to our server via the World Wide Web by entering notations, and an illustrated framework from which students can formulate, carry-out, and report their research.

The *CD Case Guide* instruction affords students the opportunity to make personal and visual connections between the school and the societal curriculum, and enables them to become active participants in the learning process. The learner has a voice in formulating and pursuing interests that relate to the topic being studied; thereby, allowing meaning to be negotiated in an environment that is mutually adaptable rather than arbitrary and teacher dominated. In such an atmosphere, students share their interests, values, ethnic, and cultural beliefs that are part of this multiethnic curriculum.

High school students are designing CDs to represent their case investigations. First, they plan the contents by creating a concept map of the components that will be included in the CD. Next, they organize their materials to fit their conceptual framework. This includes the developing of subdirectories. Then, they decide if they will include music, photographs, video clips, audio clips, simulated models, and so forth to better compliment their CD

presentation. Finally, they produce a final product that can be shared with, and used by, others to extend the research findings reported. An example of Sarah and John's map, in the form of a semantic web, represents the components of their CD (Fig. 1).

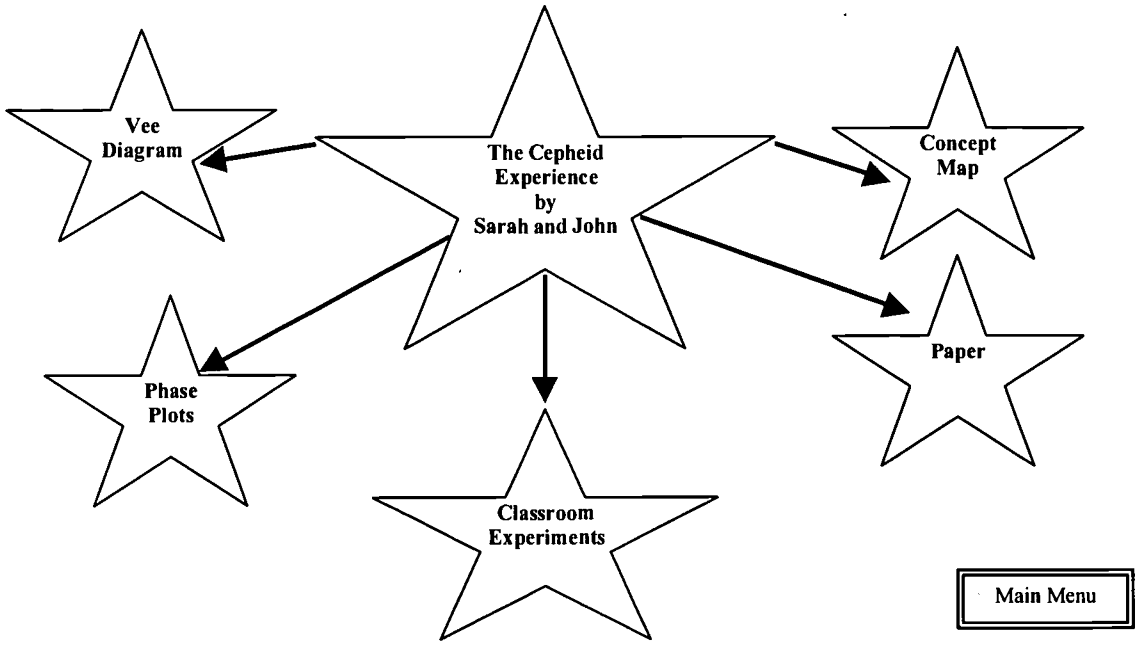

Figure 1. Sarah's concept map depicting the components of her CD with research conducted with John.

A review of her map displays the main components that will comprise her CD. Sarah also has created subdirectories within each main component that provide the viewer with in-depth portrayals of her and John's work.

5. Educational Features

The educational plan has several unique features. The sun/earth/space science educational mission involves middle, secondary, and postsecondary students promoting science and literacy in ways that differ from conventionally funded science programs that guide students to prescribed product outcomes using prepackaged materials.

5.1. Target Group

Students enrolled in astronomy, physics, and earth science classes and their teachers are targeted to participate. Due to the nature of the philosophy that underlies this educational plan, it is necessary that the teachers selected are willing to learn more about their subject area and think along with their students.

5.2. Phases

Student researchers are involved with incremental stages of phases of their cases. During each phase, students enter their notes, observations, findings, log notations, data analyses, and so forth onto a text file and publish their papers on the World Wide Web that serves as a resource for other students to access and share their thoughts. This collection becomes part of each student's computer-based working and report portfolios that are used as a tool for self-assessment and for mediating knowledge with the teacher and their peers. Students use interactive learning environments to design and share their concept maps over the Internet (e.g., Inspiration 5.0), communicate with scientists via e-mail, and engage in interactive research and collaborative planning using the *Interactive Vee Diagram* on the World Wide Web (Alvarez, 1998a, 1998c, 1997a).

5.3. Student Electronic Collaborations

Collaboration with other students affiliated with the project who share common research topics is encouraged. They share information electronically via the Internet and World Wide Web and receive feedback. When necessary, they contact community resources (people and places). This becomes an integral feature of this melding of the societal curriculum with the formal school curriculum.

Students publish their papers on the World Wide Web and receive feedback from "faceless" and "unknown" persons from throughout the world. This process not only enhances technology and literacy skills, but also develops a respect for interpreting and representing new knowledge (Alvarez, 1996b). They keep logs, correspond with scientists, and others via electronic mail, record observations and findings, make discerning judgments of papers accessed on the Internet, and incorporate related facts, concepts, and information from other content disciplines. This collection becomes part of each student's computer-based working portfolio that is used as a tool for self-assessment and for mediating knowledge with the teacher and their peers. Students share their observations and findings among the participating schools and within their own school.

5.4. Teachers and Students Voices

Teachers and their students present at scientific, mathematical, literacy, and technology conferences so their voices can be heard about their research endeavors (e.g., Alvarez et al. 1998; Stockman et al. 1998). They also develop manuals that aid other teachers and their students to record, analyze, and report the data received from the missions (Rodriguez & Hennig, 1997). Students field-test these manuals and provide input. The manuals are placed on the World Wide Web for public access.

6. Conclusion

Emerging is a change in thinking with our students using multimedia learning environments. Students are being provided with problem-solving lessons in meaningful contexts in order for them to understand new information. Since all knowledge is constructed, we need to ascertain how an individual constructs his or her mental models (personal constructs) with this new knowledge. The ways in which our students are thinking with new information is revealed through the paths of inquiry they use when confronted with authentic problem-oriented tasks. These processes are determined by the entries they make on their electronic notebook, concept maps, and interactive vee diagrams that are shared with us via the Internet.

Electronic communications are providing a forum by which these students and their teachers are communicating with each other and with others affiliated with our project. This forum takes on varied dimensions depending upon the topic being researched and the discussion emanating from interactive communications. The ability for students to share their maps and vee diagrams with others at other locations via the Internet enables them to discuss similar research topics in mutual and meaningful collaborations. The flexibility of the research design allows for this fluid exchange to occur among students, teachers, and scientists. Ideas are being formulated in ways that are not typical within traditional educational settings. NASA scientists are recognizing this innovative project as an exemplary educational program for students to engage in research investigations in authentic situations. NASA Goddard Space Flight Center has affiliated its educational program (Mars Orbital Laser Altimeter - MOLA) and the Vegetation Canopy Lidar -VCL) missions to include the educational framework of the Explorers of the Universe project. The VCL mission is scheduled for launch in February, 2000. Likewise NASA Marshall Space Flight Center has solicited this project to be an educational outreach for their Japanese American Solar Magnetograph Instrument (JASMIN) launch to the sun in 2004.

Learning and thinking with technology are ways in which students can become involved with multiple resources that go beyond the traditional classroom. Extending this frontier with problem-oriented lessons in forums that promote imaginative and critical thinking provides an effective and meaningful venue for students to learn.

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Constructing Digital Cases for Preservice Teachers: Pedagogical and Interface Issues

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Abstract: Analysis of technology literature consistently reveals that software is commonly designed without a foundation on learning theory (Ely, Foley, Freeman, & Scheel, 1992; Reeves, 1995). Within teacher education, however, there are some software developers who rely heavily on theories of case-based learning. In this paper, we analyze the theoretical underpinnings of three case-based software packages and consider the implications that case-based learning theories have for software design. Last, we report the findings from a 16 week investigation in which preservice elementary literacy teachers used case-based software to increase their knowledge of children's literacy abilities.

Theoretical Framework for Case-based Learning

Analysis of technology literature consistently reveals that software is commonly designed without a foundation on learning theory (Ely, Foley, Freeman, & Scheel, 1992; Reeves, 1995). Within teacher education, however, there are some software developers who rely heavily on theories of case-based learning. Risko and Kinzer (see Risko, Kinzer, & Baker, April, 1995; Risko, McAllister, Peter, & Bigenho, 1994) articulate the following theoretical framework for case-based learning. We used this framework to evaluate three case-based software packages. Findings reveal the effectiveness of case-based software packages designed for teacher education.

First, the softwares are based on theories of *anchored instruction* (Cognition and Technology Group at Vanderbilt, 1990) which hypothesize that students need to have a shared context (anchor) to effectively discuss their divergent perspectives. Second, the softwares are based on theories of *reflective practice* (Schon, 1983; Zeichner & Tabachnik, 1984) which argue that effective teachers evaluate their actions and outcomes. Third, the softwares are based on theories of *situated cognition* (Brown, Collins, & Duguid, 1989) which argue that learning is contextualized--thus learning and instruction should represent the context in which the learning is to be applied. Fourth, case-based softwares are based on the theory that learners make better connections when they *generate* knowledge (Risko, McAllister, Peter, & Bigenho, 1994) than when knowledge is dispensed to them. Last, case-based softwares are based on theories which argue that teaching is an *ill-structured* task (Clark, 1988; Greeno, & Leinhardt, 1986) and therefore learning and instruction should prepare teachers to make decisions based on constantly changing sources of information.

Examining Case-based Software

Based on Risko and Kinzer's theoretical framework, we analyzed three software packages developed for teacher education. Our analysis revealed that while these packages share a theoretical framework, they result in different interface designs. These designs create a continuum of case-based software which extends from information processing to generative learning environments.

At one end of the continuum, Fitzgerald and Semrau (see Fitzgerald, Wilson, & Semrau, 1997; Fitzgerald, Semrau, & Deasy, 1997) developed multimedia cases of special needs children. The user follows embedded prompts within a hypermedia interface to evaluate the special needs children. Fitzgerald and Semrau argue that hypermedia case studies are innovative learning environments which address real-world problems and allow learners to take control and responsibility for their own learning. When delivered through a multimedia format, users are able to work

independently or in small groups exploring the case scenario through video and audio, gather contextual information, review or learn prerequisite content, listen to on-line commentary provided by experts, solve open-ended problems embedded within the scenario, and revise their solutions based on *embedded prompts and scaffolds*. Hypermedia case studies, designed with embedded problem solving activities and scaffolds, can be implemented as *learning tools*, where learners take responsibility for problem identification and solution, or as *teaching tools*, where instructors guide learning activities in problem posing and critical thinking.

While Fitzgerald and Semrau's (see Fitzgerald, Wilson, & Semrau, 1997; Fitzgerald, Semrau, & Deasy, 1997) cases address the five aforementioned theoretical underpinnings, we argue that their "embedded problem solving activities and scaffolds" are based on theories of information processing and therefore minimize generative learning, reflection, and experience with the ill-structured nature of teaching. We argue that Risko and Kinzer's (see Risko, Kinzer, & Baker, April, 1995; Risko, McAllister, Peter, & Bigenho, 1994) multimedia cases are next on the continuum because they do not provide embedded prompts and scaffolds. Instead, the users are expected to peruse video clips of a classroom, examples of the teacher's lesson plans, and samples of children's work and test scores. Risko and Kinzer's software also offers several interviews with the classroom teacher, principal, students, and parents. The user is left to encounter the ill-structured nature of what occurs in the classroom, reflect on what they find in the software package, and generate his/her own purposes for exploring the multimedia classroom. In other words, the software is basically a multimedia data set of activities in a classroom. The software interface offers random access to the data set.

While Risko and Kinzer (see Risko, Kinzer, & Baker, April, 1995; Risko, McAllister, Peter, & Bigenho, 1994) offer less structure in their software interface, the software content focuses on *classrooms*. Next on the continuum, the we argue that teacher reflection typically begins with *the student(s)* which in turn fosters reflection on the classroom. Thus, through a grant from the USED/FIPSE, we are currently developing multimedia cases of individual children as they progress through a school year. These cases include information about the classroom and school activities, thus situating the child/case in a broad context. Similar to Risko and Kinzer, we do not offer embedded problem solving activities or scaffolds in the interface design. Unlike Risko and Kinzer, we shift the focus of the software content from classrooms to *individual students* as they work with classmates and the teacher during normal classroom activities. The software interface and content design are intended to give access to data that teachers commonly encounter as they determine the growth and development of their students thus fostering all aspects of the aforementioned theoretical framework.

Methodology

The purpose of this study was to examine the effectiveness of our case-based software. In order to accomplish this purpose, we evaluated two phases of the project: interface design and pedagogical effectiveness. During both phases, we used many data sets and analyses techniques.

Interface Design

In order to evaluate the interface design, we used expert reviews, usability studies, and alpha and beta tests. Throughout the evaluation process, we focussed on how well the cases illustrated children's interdisciplinary literacy processes and how well the software interface supported access to children's literacy processes over time.

In order to validate the authenticity of the cases and the usability of the support materials, the cases were reviewed by a panel of experts in the area of literacy process analysis. The software interface was evaluated by a panel of software development experts who focussed on issues such as interface design and software execution. We made revisions to the case content and interface design in accordance with the reviewers recommendations.

Pedagogical Effectiveness

We evaluated the effectiveness of the case based methods by analyzing the preservice teachers abilities to 1) engage in anchored instruction, 2) reflect on their practice by discussing and revisiting the anchor shared with peers and instructors, 3) situate their learning, 4) experience generative learning, and 5) gain experience with the ill-structured nature of teaching. Formative procedures were based on data from classroom observations, and reflective journal

writing. Described below, these data was used to make adjustments in the cases and materials to increase their impact on the participants.

Participants

The participants were preservice teachers who were Junior elementary education majors enrolled in their first series of methods courses. Prior to enrollment, they observed and taught in an assortment of K-12 schools and classrooms. Participant selection was based on enrollment--those who enrolled in Section 3 were the participants. No participants declined involvement.

The instructor was a principal investigator of the project. The other principal investigator and two research assistants observed in the class and videotaped class sessions. An external reviewer observed one class session and met with volunteer students to discuss the effectiveness of the cases.

Data Collection and Analysis

The instructor used action research methods to collect and analyze data. Specifically, in collaboration with the researchers in her classes (principal investigator, research assistants, and external reviewer), she discussed her perceptions of the effectiveness of case-based assignments and class discussions. The instructor made pedagogical decisions based on suggestions and insights offered by the other researchers. The instructor also wrote reflections about each class session. In particular, her reflections focussed on the social norms of the classroom and the preservice teachers' development with anchored instruction, reflective practice, situated cognition, generative learning, and the ill-structured nature of teaching.

The instructor's data was triangulated by the following data collection and analysis methods.

Classroom Interaction Observation. Classroom interaction observations occurred during the regularly scheduled on-campus class times (15 3-hour sessions) and focussed on the interaction patterns that occurred among the instructor and the preservice teachers. A research assistant used a Class Interaction Analysis protocol to chart the frequency of interactions, categorized in terms of question patterns, response patterns, and interaction patterns. We are in the process of transcribing pertinent videotapes of class sessions which were coded according to: 1) type of question, 2) purpose of discussion, and 3) content of discussion. Frequencies and percentages were computed and an Analysis of Variance were performed on the total data set. These interaction patterns provided information about the preservice teachers' abilities to 1) engage in anchored instruction, 2) reflect on their practice by discussing and revisiting the anchor shared with peers and instructors, 3) situate their learning, 4) experience generative learning, and 5) gain experience with the ill-structured nature of teaching.

Reflective Journal Writing. The preservice teachers wrote reflections about their field experiences throughout the semester. Analysis of these writings focussed on 1) references to the cases/anchor, 2) situated learning, 3) the generation of knowledge (verses expectations of having knowledge dispensed to them), and 4) references to the ill-structured nature of teaching. Our analysis was based on a framework for reflective thinking developed by Sparks-Langer et al. (1991) which provides a rubric for evaluating preservice teachers' ability to reflect on pedagogy and practices that underlie teacher decisions. This rubric also measures six levels of cognitive reflection: 1) non-descriptive language, 2) simple lay-person language, 3) events labeled with appropriate terms, 4) expressed with traditional or personal preference given as the rationale, 5) expressed with principles or theory given as the rationale, and 6) expressed with principles or theory given as the rationale and consideration of context factors.

Pre and Post tests. Pre and post test measures related to preservice teacher development were administered during class 2 and again during class 15. These tests included quantitative and qualitative procedures. Specifically, the measures included a teacher beliefs inventory, a paper and pencil assessment of literacy knowledge, and a video-based analysis of a child's cognitive literacy strategies. Each measure was examined for relative change in the preservice teachers' growth and development and was be used to judge the effectiveness of the cases in helping preservice teachers to analyze children's literacy strategies. The analysis procedures included categorizing, sorting, and computing ANOVA to determine significance.

Case analyses. During the semester, 8 of the 15 class sessions involved using the multimedia cases. During each of these sessions, the preservice teachers were given reflective questions to answer. Their answers were collected and analyzed for growth in 1) references to the cases/anchor, 2) situated learning, 3) the generation of knowledge (verses expectations of having knowledge dispensed to them), and 4) references to the ill-structured nature of teaching.

Self-evaluation. A group of 4 volunteers were asked to examine their analysis of the cases throughout the semester and evaluate their own growth. These self-evaluations were videotaped and analyzed for triangulation.

Findings and Discussion

Fitzgerald and Semrau (see Fitzgerald, Wilson, & Semrau, 1997; Fitzgerald, Semrau, & Deasy, 1997) have substantiated (through a series of studies with hypermedia case studies implemented with preservice and experienced teachers in multiple universities) that significant levels of pre/post knowledge construction occur when using hypermedia case studies as learning tools *regardless* of:

- prior computer experience
- prior teaching experience
- prior knowledge in the content area
- rank of undergraduate vs. graduate
- cognitive style of field independence vs. field dependence
- learning style of accommodator, assimilator, diverger, or converger.

The implication based on two assumptions—availability of robust, hypermedia case study materials and motivated learners—is that use of hypermedia case studies implemented as *learning tools* level the learning field for preservice teachers with different learning characteristics.

Risko and Kinzer's (see Risko, Kinzer, & Baker, April, 1995; Risko, McAllister, Peter, & Bigenho, 1994) work is significant to software design because they found that their multimedia cases have the advantage of subsuming all of the other types of cases within them, thus allowing an instructor the freedom and flexibility to choose among a variety of case types and presentation modes. In addition, however, important questions about the use of multimedia cases emerged, such as:

- Does instruction have to move into computer laboratory settings for case-based instruction to be effective?
- Do students have to have computer access in their dorm or home in order to effectively complete homework assignments based on multimedia cases?
- Can multimedia cases be effective across a variety of instructional situations, or does the addition of video and audio constrain multimedia case use to a given region of the country?
- Do multimedia cases have implications for Internet use and distance learning?

With regard to our study, at the time of this report, data collection is complete while data analysis is ongoing. Initial findings indicate that a non-tutorial interface (which does not include embedded prompts or scaffolds) is an effective interface design for case-based learning. In particular, the instructor reported that she was not limited by the interface when she wanted to shift analysis from the child in the case to the decisions the preservice teachers would make if they taught the child. Feedback from the users indicate that instead of embedded prompts or scaffolds, they need basic descriptions of the situations provided in the case. They also need access to the books the children read and the ability to print out the texts the children read--so they could analyze the discrepancies between what the texts said and the child read.

Returning to the theoretical framework, initial analysis reveals encouraging results. First, with regard to *generative learning*, the preservice teachers went from generating 20% of the classroom discussion about the cases to 100%. We are currently analyzing the quality of what these students generated. Second, with regard to *anchored instruction* we found the preservice teachers spontaneously shared their divergent experiences (from the semester's field experiences, previous field experiences, their own experiences as elementary students, and baby sitting experiences) to help each other understand the cases. Third, the preservice teachers actively *reflected* and grew in their abilities to focus their reflections on pertinent issues. For example, their initial reflections focussed on general judgements about whether the child in the case was a good or poor reader. Their reflections developed into analysis of the child's abilities and instructional plans for the child. The appropriateness of the analyses are being analyzed.

Fourth, the students requested more in-depth information about the *situations* in the cases. This indicates that the students understood the importance of understanding situations before making judgements about children. Analysis of the preservice teachers' reflective journals, classroom videotapes, and self-evaluation protocols will reveal more about whether they made similar assumptions about their field experience. Last, the students commonly reported that the case discussions helped them understand that everyone in the class had different opinions based on different observations of the same data. This exposure to classmates' opinions helped them recognize that *teaching is ill-structured* and does not necessitate one plan of action; rather, several plans of action may be appropriate.

Conclusion

Comparing the software design features of these three case-based multimedia software packages offers insights into how software designers can adhere to similar learning theories (e.g., case-based learning) and apply them very differently during software development (e.g., embedded prompts, focus on the macrocontext--classroom, focus on the microcontext--students). Comparing findings from these three case-based software packages reveals what kinds of learning can occur and the impact that the software development can have on learning.

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Components of Effective Web Course Design: Aesthetics, Navigation and Content Networks

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Although the Web was not designed as an educational medium, current pressures exist to develop it as a means of delivering instruction. The lack of design standards and the open environment of the Web are obstacles to instructional designers developing on-line Web courses. The design components of aesthetics, navigation, and content networks are important considerations in the development of instructional Web sites. These components combine to contribute to the success of a Web based course, primarily by keeping the user engaged in the Web site.

The pressure on educational institutions to provide Web based courses increases exponentially as access to the Internet increases. (Hirumi & Bermudez, 1996). Instructional designers will be expected to create web pages which are interesting and appealing to sophisticated consumers of multimedia. (Shotsberger, 1996). Understanding the interaction of aesthetics, navigation and a content network can provide a design paradigm for developing effective instructional web design.

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Web-Based Instruction: Focus on Learning

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Abstract: The higher education environment is currently being revolutionized by the challenge of on-line course offerings. Many obstacles stand ready to confront those instructors who are faced with the task of utilizing this new instructional environment. The instructional aspects of Web-based learning are often viewed as secondary to the technical issues that require a new set of skills for most instructors. This paper suggests that it is important to apply instructional design to the many aspects of designing and delivering effective web-based instruction.

Introduction

Back in the old days (before 1995) the prime concern among educators was devising a way to get students to interact with the material. Practically every journal or trade publication delved into the problem of instructional design. The articles had various names and approaches, but they surely tackled the problem of increasing student learning. The post 1995 world has embraced the Internet and its more specialized sibling, the intranet, as the instructional delivery system of the future -- and with good reason. The Web provides wide access, with the capability of providing multiple media formats efficiently and effectively. Solutions to the bandwidth problem abound and run the gamut from streaming media to various new hardware to hybrid solutions (Fryer, 1997; Reid, 1997). It seems, though, that as we charge toward more web-based instruction (WBI), we seem intent on solving the technical problems, but have forgotten about the learning problems.

Much of web-based publishing has become the purview of the technician and the content expert. This paper suggests that instructional design needs to be resurrected so that we may focus on learning as opposed accessing vast amounts of information. Instructional design presents a selection of models, each focused in a different way, all intended to enhance learning. Gufstafson (1991) classifies them into classroom, production, and systems models. Classroom models such as Kemp's (Kemp, Morrison, & Ross, 1998) generally focus on a product which is segmented into lessons of specific time intervals. Production models such as Bergman and Moore's interactive video/multimedia model (Bergman & Moore, 1990) focuses on the assembling of a coherent product. Systems models, including the prototype Dick and Carey model (Dick & Carey, 1996) focus on problem solving by a large team over a wide array of content.

For the design of WBI we would suggest a product orientation that is learning sensitive; that is, look toward getting the product on-line, but design for the learner. Simplified, this model includes the phases of analyze, design, develop, disseminate, and evaluate. Similar in design to Hannafin & Peck's model (1988) for design of computer-based instruction, the web-based instructional design model includes the steps analyze, design, develop, disseminate, and evaluate, shown graphically in Figure 1.

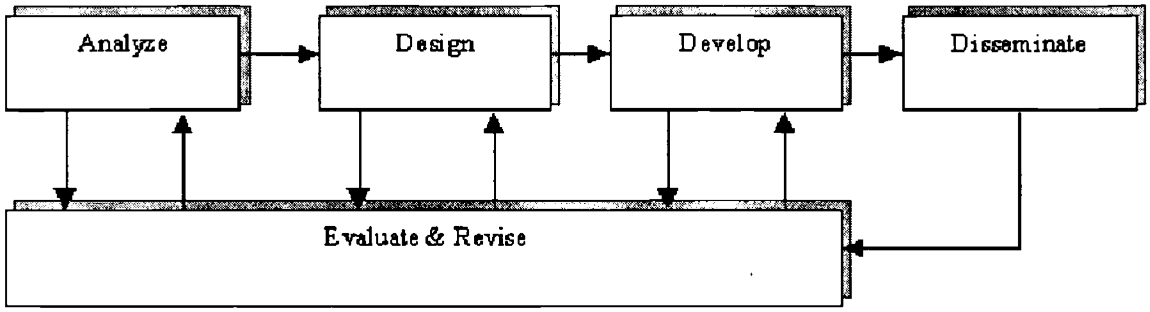

Figure 1: Web-based Instructional Design Model.

Analyze

Production models typically do not focus on needs assessment, but in this case, it may be the most important part of the process. Institutions must resolve the "Why do we want to do this?" issue before moving on and they must come up with some realistic answers to that question before embarking on any design and development program. Individuals must ask personalized versions of the question as well. The answer will drive the institution's or individual's approach to responding to many related issues. Possible institutional answers to this key question include:

- To provide more convenient access to education.
- To serve a previously unserved / underserved population.
- To protect the share of the instructional market.
- To expand the share of the instructional market.
- To become a national leader in the web-based instructional market.

Faculty answers may include:

- To provide more convenient access to education for their students.
- To develop personal skills and expertise.

Another important issue is the identification and commitment of resources to the project. WBI, like any multimedia project, requires significant development time. According to Golas (1993) up to 600 hours is required to develop one nominal hour of multimedia instruction with costs being up to $500,000 per nominal hour of instruction. Additionally, Golas stresses the need for commitment and planning to the project or the project faces increased risk.

Once the faculty and administration identify the need for web-based instruction, the next step is to establish the instructional goal. For most, this involves choosing the content and is a relatively straightforward task - maybe even one that has been predetermined. However, it is essential to understand the impact of the use of web-based instruction as a delivery system as you evaluate the content to be presented.

It is important first, to analyze the learning task to determine the most appropriate means of delivery. An obvious example of inappropriate content would be a course in which the content is primarily psychomotor in nature. The delivery of the content would require an emphasis on motion, most likely through video, which requires increased time and technical skills to convert to a web-based format. Often psychomotor training demands constant and immediate feedback from the instructor. Therefore, not only would the delivery of the content be problematic but also authentic assessment of student performance would be challenging at best. At this fundamental step of the design process, care must be taken not to assume an automatic fit of content to delivery medium. This is a primary concern if an institution is attempting to offer entire programs of study through the Web.

Internet attributes that differ from traditional methods of delivering instruction include level of interactivity and the ability to link both people and content. Success of any technological innovation is usually dependent on a solid match between and appropriate use of the unique attributes of that medium. An initial assessment of the content should identify how the Web will be used. According to Brandt (1997) possibilities include: simple delivery of content similar to an electronic manual, delivery of instruction that is supplemented by other content on the Web, utilizing instruction such as tutorials that already exist on the Web, or some

combination of these. The best use of the advantages of the Web is to maximize the potential for interactivity and linking. Instructors can take advantage of these options by carefully analyzing the content in conjunction with these unique Web elements.

In addition to defining the content, the learner of the WBI must be analyzed. The most important element in the instructional design process is the learner. Dick and Carey (1996) describe the need to determine the learner's attitudes toward the content and the delivery system. The impact of the Internet as a delivery system creates a need to identify specific characteristics that learners need to possess. Web-based instruction includes characteristics that inherently make demands on the learners. This may cause problems, because many times it is almost impossible to define the target audience. Careful analysis of the need for web-based instruction may help to better define the learner. Still, the designer is faced with designing for an ill-defined audience.

One skill that must be taken into consideration is reading ability. While the Internet has the option of incorporating graphics, audio, and video, the primary delivery mode is still printed text. The learner must have the skill to read at the level at which the information is presented and be able to rely heavily on reading as the primary mode of gaining information. For students whose preferred modality of learning is other than reading, WBI might present particular challenges. In traditional classroom instruction, auditory lecture or auditory group discussion augments print information. Audio information in web-based instruction is usually limited and will not simultaneously provide the learner with additional channels of communication.

Web-based learning requires that the end user assume responsibility for control of many aspects of the course. The learner can no longer be a passive recipient of instruction; instead web-based courses require active student participation (Ebersole, 1997). In a traditional classroom, a student might "show up" for class and not actively participate but still be viewed as present. In a web-based course, the student must actively engage in on-line dialogue in order to be an active participant (Harasim, 1996). This dimension might be problematic for those learners who avoid risk-taking behaviors in the traditional classroom environment. However, Harasim points out that the asynchronous nature of bulletin boards, listservs, and e-mail can be a positive attribute that allows learners time to prepare prior to participation in an on-line discussion or activity.

Web-based instruction also requires that the learner be self-directed and possess the initiative to work at a steady pace. The student who is used to arriving in a classroom setting at a particular time, having the instructor structure and guide the learning process, leave class at a particular time, and have assignments due at a set time, will need to adapt to the different organization of web-based instruction (Wulf, 1996). Courses are more flexible and offer students more options. The end user will probably control the pace at which the course is approached and will have more opportunity to select meaningful course content. They can set the pace at which they proceed through the course and can go back and refer to difficult sections. The course content allows the learner the flexibility of moving through the course in different sequences. While that is certain to appeal to many individuals, the reality of this responsibility might be foreign for those who are used to the structure of a traditional classroom environment.

Learners must possess a degree of technical savvy and have access to computers and software capable of supporting on-line technologies. The end users must know how to utilize various aspects of the technologies including navigating on the Web, sending e-mail, and participating in listserv discussions, and bulletin board groups, to name a few. For those learners that possess some technology background, one option might be to engage them in on-line training (Brandt, 1997). However, for the students that lack computer experience, other forms of initial training might be required. Regardless of the learner's technology skills, the instructors of WBI should anticipate some lag time between the beginning of a course and the class participants' readiness to engage in on-line activities (Boettcher, 1997).

Design

Williams and Papprock (1993) made the critical observation that the intent of instruction is to have the learners involved in the learning process rather than merely learning to use or adapting to the technology delivering the instruction. Because web-based instruction has so many variables that differ from traditional instruction, consideration must be given to approaches framing the design of the instruction so that successful learning can occur.

Behaviorism has been central to the system process since the inception of instructional design. More recently, constructivism has been viewed as an essential component of the learning process. Norman (1997) recommends a hybrid approach utilizing both behaviorism and constructivism for designing web-based

instruction. This approach is necessary to provide structure and sequence as well as a meaningful learning environment. Web-based instruction demands that the learner take an active role in the learning process with an increased emphasis on constructing knowledge (Harasim, 1996). As Ebersole observed, "The learner must be actively engaged in the learning rather than merely 'receiving' some message" (1997, p. 21).

Muffoletto (1997) observed the need to design on-line instruction that is student-centered rather than teacher-centered. Parker (1997) recognized that the role of the student is changing from the passive learner to "an active, autonomous developer of personal knowledge" (p.7). This change of focus in responsibilities requires reevaluation of any existing course design. As Parker observed, merely adding material to an existing traditional course will not provide the solution for successful on-line courses. Course design must force involvement and interaction among the students. Parker suggested that student participation should be framed in real-world problems that require higher-level thinking skills.

The design and structure of the course content should be based on the use of terminal and enabling objectives (Bernstein, 1998; Ebersole, 1997). One advantage to WBI is that learners do not have to move through the learning process sequentially. This advantage might be a limitation for content that requires a building of skills or knowledge for the learner to proceed through the instruction. Using terminal and enabling objectives, the designer provides structure and sequences that serve as a road map to guide the learner through essential skills. This approach also provides the learner with a sequence to refer to for the purposes of remediation or enrichment. The use of sequence is also an important consideration for keeping the student focused and on task. The option of having immediate access to unlimited information is a fundamental quality of the Internet, which is not characteristic of any other medium. With the limitless links available on the Web, it could be easy for the student to wander off the intended course of instruction.

Develop

The presentation of the content itself is very important. Initially, the learner must choose to interact with the material. The material must be presented in a logical and motivational manner using a layout that will provide consistent clues and procedures for the learner. For example, the overuse of links can provide the learner with overwhelming options. Because of the dynamic quality of the Web, design options range from linear-sequential to learner directed paths. Attention should be given to the relevance of content that requires the user to link to other sites to insure that the content is essential to the learning. Once the decision has been made that another site contributes to the instruction, it is important to help the user know where they are headed, with clear distinctions between different types of links. Ebersole (1997) suggests identifying links that will take the user to another site and differentiate those links from ones that will link the user with another location within the current site.

Page layout should be approached in a manner that is instructionally sound and at the same time motivational because the learner will be using the Web for a major portion, if not all, of the instruction. With any form of visual instructional media, it is important to follow basic guidelines for visual message design. The primary consideration is to keep each page simple enough for the learner to feel capable of managing the information presented. Each page should be designed with the instructional objective as the main focus considering the most effective manner of presenting the information. Options include text, graphics, animation, audio, and video. These basic media selection decisions have implications throughout the design and development phases because each medium requires additional support which could include: instructional designer, Web master, content researcher, graphic designer, and development and production producer (Boettcher, 1998).

Another design issue is determination of the context in which learning will take place. Learning can either be a solitary experience or it may include group interaction (Wulf, 1996). If there is no need for the learner to interact with others during instruction, communication might be limited to receiving e-mail or downloading information from the Web. However, if learning will be enhanced via group interaction, options include email and listserv discussion groups, bulletin boards, downloading, interactive tutorials, and real-time conferencing (Wulf). Group interaction is further enhanced by web-based instruction because learners have the option of selecting collaboration because of "shared interests rather than shared geography" (Harasim, 1996, p.207).

Disseminate

The history of the field of instructional technology is filled with examples of new delivery systems that at the time were viewed as a panacea for education. For each, there was a moment in which a large portion of instructional content was being converted for application via that delivery system. Hindsight, of course, has shown that these trends have been short-lived and largely unsuccessful. The primary issue has been the desire to force all content to fit the latest technological innovation. Therefore, any discussion of designing web-based instruction should assess the fundamental consideration of fit.

Online education shares some attributes of traditional classroom education such as the need to identify the course content and to create opportunities for students to experience learning. However, there are many differences from traditional education. The traditional classroom model relies on the instructor delivering and managing all aspects of instruction. Because of the absence of an uninterrupted on-line instructor who can continuously monitor student learning and modify classroom activities, there is a need to evaluate pedagogical issues. Online education actually involves reevaluating the communication model as the primary form of education.

Lyman (1996) suggests that while the Internet is technically identified as a network of networks, the real characteristics of this new form of communication are largely unknown. Communication has been the model in the center of learning symbolized by the sending and receiving of a message through some form of transmission. Harasim (1996) points out "In this model, a body of knowledge external to the learner (such as information in a lecture or textbook) is transmitted to the learner, and the responsibility for optimal transmission is on either the message, the message source, the transmission conduit, or the receiver" (p. 205).

This concept of learning focuses on the transmission of information to a receiver. Certainly, the successful design of WBI relies on the ability to transmit or send the essential information that the learner will need in order to acquire the skills or knowledge required of the content. The challenge for the designer becomes one of facilitating the delivery of the content to maximize the potential of the Internet so that the majority of learners successfully acquire the skills or content.

Evaluate and Revise

This is a critical phase for the WBI development process. It provides designers and developers the opportunity to "fine tune" the instruction, making sure that it is focused in the right direction. We would recommend a modification to what has become a "standard" three-phase model for formative evaluation (Dick & Carey, 1996). The five phases are:

- Design review,
- Expert consultation,
- One-to-one,
- Field trial, and
- Maintenance.

We suggest that formative evaluation be carried out continuously, as is shown by our model in Figure 1. Then each phase is subject to continuing internal review as it is being designed and these changes impact other phases. As those impacts are felt, the designer continuously and iteratively changes affected phases. Expert advice and analysis is critical to good design, therefore they need to be included. Most products are designed by teams and so are made up of individuals with widely ranging talents -- from content expertise (so called subject matter experts or SMEs) to learner specialists to graphic design and others. Each expert will bring his or her own perspective to the design. The source of the expertise may be internal or external to the design team. When experts are available from within the design organization but external to the design team, they would serve as a good source. They tend to provide less bias-- perceived, or actual.

One-to-one evaluation provides the designer a way to test the product with learners similar to the target audience. Using a think aloud protocol, the designer may observe the learner use the instruction noting learner problems and tendencies. This would be a very interactive session. Learners of various types and especially aptitudes should be observed.

Following this, the course could be used in a test market with a limited number of learners to determine how the instruction performs in the instructional environment. Changes in the instruction will be less likely because of the extensive formative evaluation proceeding this phase. Designers should expect,

though, to modify the transmission and distribution system. Finally, maintenance evaluation provides the WBI team an opportunity to continuously update and improve the instruction as feedback from the users and results of assessment instruments show a need for change.

Conclusion

The increased use of the World Wide Web has created a unique environment for offering courses that will undoubtedly continue to become a force in education. The success of the use of this technology relies on the instructional designers' abilities to incorporate the unique attributes of this delivery system and utilize these characteristics in a manner that focuses on successful learning.

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The Importance of Motivation: Integrating Flow Theory into Instructional Design

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Introduction

It seems a truism but when people are intrinsically motivated to learn, they not only learn more, they also have a more positive experience (Deci & Ryan, 1985). Handicapped by a lack of good theoretical framework, designers often assume that good quality instruction is by itself motivating (Keller, 1983). When motivation is considered, it is often simply seen as steps that must occur prior to instruction, such as "gaining attention" or "orienting the learners" rather than as a central element in the instructional design itself. Traditional instructional design is concerned with different issues from those of motivation. Instructional design focuses on learning, while motivation is concerned with emotional issues.

Keller (1983) attempted bridge this gap between instructional and motivational issues. His theory however was limited due to the fact that it devoted little attention to other variables (Snelbecker, 1987). Keller's constructs, nonetheless, provide a good theoretical congruence between Csikszentmihalyi's flow theory and traditional instructional design. Flow is an optimal psychological state (Csikszentmihalyi 1975; 1982; 1985; 1988; 1990; 1994; 1997) in which people become so intensely involved in an activity that nothing else seems to matter. The experience is so enjoyable that they will do it for its own sake.

Keller and Csikszentmihalyi emphasize the importance of five design elements: challenge, goal, concentration, control and feedback. At its most basic, flow theory is simply a description of people enjoying themselves. The goal of this study was an exploratory adaptation of flow theory for designing instructional activities. We explored how to use flow theory and its effects on motivation in a classroom setting, which typically has less than optimal conditions.

Methodology

Flow theory provides an instructional designer several structural variables that can be manipulated in order to increase the likelihood that a learner will be motivated to continue learning. We selected four flow constructs from the total inventory of nine, and pairing the selected constructs: challenge with a goal, concentration with control, forming two independent variables, content relevance and presentation quality.

Treatments

The first independent variable is content relevance. A teacher can manipulate the level of motivation by simply providing a meaningful goal, i.e. content relevance. The student is told to search for material relevant to a class project. The second independent variable was the quality of the material presentation. By using multimedia, with its attendant sight and sounds, we can affect a student's motivation level. To investigate this problem we designed a 2x2 factorial design. The four treatments were administrated with two levels of content (reading vs. searching) and two levels of presentation (traditional vs. hypermedia).

Instrument

We used the Flow State Scale (FSS) by Jackson (1992; Jackson & Marsh, 1996) to assess flow experience. The FSS is a 36-item, 5-point Likert-type scale, with 4-item for each of the nine flow dimensions.

Procedures

Data was collected during regular class activities during spring semester.. The entire class was instructed to work on their assigned task. After 30 minutes, the students were asked to reflect upon their experiences during the lab session while completing the self-reported questionnaire.

Data Analyses

The data was analyzed using multivariate statistics on scores of the Adapted FSS.

Results

The results revealed a significant interaction effects for the flow total scale ($p<.005$), and the remaining subscales: challenge ($p<.0004$), goal $p<.0031$), feedback ($p<.0068$), awareness ($p<.001$), control ($p<.04$), consciousness ($p<.025$) and time distortion ($p<.0088$). Simple main effect analysis of interaction indicated that participants using a high quality presentation scored higher on the total scale ($p<.005$), as well as on the challenge ($p<.0004$), goal ($p<.002$), feedback ($F(1,38)=5.39$, $p<.02$), awareness ($F(1,38)=21.11$, $p<.0001$) and consciousness ($p<.002$) subscales. However subscales at the low content relevance activity were not significant so that there was no presentation quality effect on flow and its subscales. Participants in high content relevance activity scored higher on the challenge ($p<.02$) and feedback ($p<.02$) subscales while using the low presentation quality platform. However, participants in the low content activity scored higher ($p<.01$) on the awareness ($p<.0001$) and consciousness ($p<.001$) subscales when using a high presentation quality platform.

Discussion

Flow theory argues that the structure of the activity can have major influences on motivation. This study suggests that multimedia is a double-edge sword for instructional design. Multimedia can add appealing elements to an instruction activity that can motivate students and facilitate flow as long as they are used appropriately. As instructional designers, we must integrate multimedia elements into the lesson carefully, or it has negative consequences. When the content relevance is complicated high level complex presentations can be distracting. Consequently, multimedia elements should be used sparingly at the beginning of a lesson when challenges are high and students are unfamiliar with the material. As the lesson progresses multimedia could be used gradually as the content challenges are reduced. This study is only a beginning in the formulation of a prescriptive model for the motivational aspects of instructional design based upon the flow theory. There is absolutely no reason why the classroom or other learning environments cannot release as much excitement, energy and achievement as are seen in sport stadium and playing fields around the world every weekend. More researches and explorations in the motivational aspects of instructional design will help to transform the classroom from a place where students "have to be" to a place where students actually "want to be".

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Employing Adult Education Principles in Instructional Design

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Abstract: An instructional systems approach to learning draws on principles of instructional design and development but also draws from theories such as behaviorism, information processing, cognitive theory, adult education, and systems theory among others. This paper focuses on how instructional designers can benefit from awareness of different adult education principles or theories. Traditionally instructional design is taught by connecting educational psychology via learning theories such as behaviorism, cognitive theory, and/or constructivism to learner design considerations. Although this is an acceptable manner for introducing instructional designers to varying educational theories, it does not provide a unified epistemology of learning and knowledge creation. This paper presents theories that reflect one primary view, that is, learning is an interactive process constructed by the learner and not passively received from the environment; the basis for which adult education is based. Applications of these adult education principles are then applied to instructional design issues.

Introduction

Numerous theories of learning have been established and published in educational psychology literature. Instructional designers, among the many hats they wear, need to have a strong foundation in learning theory, as this is the basis for which many instructional design decisions is based. Besides knowledge of these theories, they must also be able to apply theoretical views of learning to actual instructional practice. One way of doing this is to have a solid grasp on the nature of learning. This means an instructional designer must actively engage in a reflective process of self-awareness for which his/her personal beliefs of learning as based. This process is not easily accomplished. The presentation below of instructional design and adult education involved a personal introspection of the author's beliefs, through a review of many educational theories, to provide a framework for his future instructional development in adult education. This presentation is not meant to be a solution for all adult instruction creation, but is provided as a perspective for which others can based their personal models.

Instructional Design and Learning

Instructional design is a process of resolving instructional problems through systematic analysis of learning conditions. In the process of creating instruction, a designer draws upon knowledge and theory from psychology, education, communication, and technology (Seels & Glasgow, 1998). One way to represent the various components of instruction is through instructional design models. To date there are over 150 different models cited in the literature. Although there are many different models there is one common component, the learner. The major difference comes from how the learner is viewed as acquiring knowledge. These views have come primarily from educational psychology theories.

Traditionally, application of learning theories to instructional design has come from a body of literature that has grown from behavioral and cognitive psychology (Hiemstra & Brockett, 1994). Reigeluth (1983) recognized works of Skinner, Ausubel and Bruner as having a large impact on instructional design. The most recent influence on instructional design comes from constructivist psychology. The constructivist approach is primarily concerned with the way individuals construct knowledge based upon experiences, mental structures, and beliefs (Jonassen, 1991). The paradigm shift from behaviorist psychological approaches to cognitive psychology and even to constructivism has created quite a stir in the instruction design arena. This shift has been responsible for proliferation of many newer instructional design models.

Application of design methods to learning situations, therefore, is based upon the perspective taken concerning knowledge acquisition. A traditional approach to this issue has been creating a model that represents a design process reflective of the psychological perspective associated with beliefs in learning. This is an acceptable method for mapping design decisions, but often leads to situations where other designers ignore the underlying psychological tenets concerning knowledge acquisition.

Adult Education and Learning

Adult education as a discipline has developed from several lines of inquiry (Hiemstra & Brockett, 1994). Merriam and Caffarella (1991) has shown adult learning theory growing from research addressing questions of why adults participate in learning, and knowledge of adults as learners. These issues give rise to varying views about adult students, and their ways of learning. Theories such as Knowles (1980) Androgyny, Mezirow's (1981) Theory of Transformational Learning, and work in the area of self-direction in learning (Cross, 1981; Tough, 1979) have impacted the adult education field. Sociological perspectives of teaching and learning have also been advocated by Jarvis (1985). Brookfield (1986) and Mezirow (1981) which endorse awareness of critical thinking in adult education theory. The results of theory development in adult education has lead to varying views about how adults learn, however, there are many common components can be seen in all these theories.

A review of some of the prominent adult learning theories is important prior to application to instructional design. There are four theories that have been widely written about in adult education, they are:

- Knowles' Androgyny
- Self-directed learning
- Knox's Proficiency Theory
- Mezirow's Transformational Learning Theory

Knowles Androgyny

Knowles' androgyny has been considered one of the first adult education theories which has been defined as the "art and science of helping adults learn" (Knowles, 1980, p. 43). Although a lot of work had been done in adult learning at the beginning of the 20th century by psychologists like Thorndike, most of these issues dealt with memorization and attrition of memory over time. It was not until the mid-1900's (1950-1960) that educators started getting directly involved in adult learning. During this time period the big focus in the United States research lied primarily on behavioral and empiricistic views of learning. During these decades, information was independent from the learners and learning was an objective process. Any learning where the "learner was active in constructing meaning and interpreting experience" (Pratt, 1993, p. 16) there was knowledge and truth compromise.

In the late 1960's Knowles looked at adult learning patterns and started making comparisons to how children learn. Changes in Knowles thought about adult learning occurred between 1970 and 1980. One of Knowles books, *The Modern Practice of Adult Education: Androgyny vs. Pedagogy* was later re-titled *The Modern Practice of Adult Education: From Androgyny to Pedagogy*. This revision showed a continuum of learning rather than differences per se in learning between adults and children. His belief was that learning could be teacher-directed or student-directed or anywhere in-between. "Thus, while androgyny does not define the uniqueness of adult learning, it does provide a set of guidelines for designing instruction with learners who are self-directed than teacher-directed" (Merriam, 1993, p. 8-9).

His primary premise remained the same, that is, learners where not passive participants in learning but actually individuals whom partake in their own learning. Knowledge, in his opinion, did not just exist out in the world for individuals to acquire but could be created by learners. Adults were individuals who took responsibility for their own learning. In revising the second edition of his book, he did not throw out the pedagogical principles but identified how they were involved in both adult and childhood learning. His general thought was that individuals (whether adults or children) when learning a new subject matter often needed direction and would seek a more "traditional" behaviorist-type learning approach. Information could be provided for them by a subject matter experts or resources. As a student (adult or child) acquired more knowledge about a subject, he or she became more independent and sought after his/her own learning experiences. Thus, one of the things Knowles is known for is his investigation into the transition from structured teacher- centered learning to a less structured student- directed

learning. The originally thought according to Knowles was that adults followed the student- directed learning approach while children followed a teacher- directed approach. This was found to be untrue; both adults and children can participate in both types of learning. This meant that learning for children and adults were not really as different as once proposed.

One major influence of differences in adult and children learning came from the environment where learning occurred. Children are placed in a classroom for instruction, while adults are often taught in a non-structured, on-the-job training environment. Thus it can be shown that environmental conditions play a role in the learning for both adults and children.

Self-directed Learning

Self-directed learning (SDL) was derived from the work of Houle's (1961), Tough (1971, 1979), and Knowles (1975). The theory is "grounded in the notion that adults are independent and thus self-directing" (Merriam, 1993, p. 9), it also goes as far as saying that individuals are self-motivated and often create their own learning. Although many adults would not consider themselves as learners, Tough's research (1971) showed the nearly 90% of adults participate in learning projects, and 70% are planned by the learner.

Self-directed learning is where an individual takes responsibility for his/her own learning, and acquires knowledge through independent training. This independence is not resource free. Many SDL learners will use the library, textbooks, or the Internet to gain some of the information that wish to acquire. The type of learning is usually self-initiated. Brockett and Hiemstra have written extensively in this area. They report that some individuals have a difficult time acquiring the ability to direct their own learning and that this type of learning can cause frustration. Part of this frustration is grounded in the types of learning that occurred during their younger years (i.e. was information fed to students or did they have some free thought). If information is provided to learners and they do not have to make decisions about what they want to learn and how they acquire this knowledge then they will not have these skills in their latter years. By teaching students in a guiding manner and allowing them to make decisions about what they want to learn, students gain the ability to learn independently. One of the main facets of SDL is students make decisions about the subject matter they want to learn and how they want to achieve their own learning. Learning objectives are not created by the instructor but by the learner.

Recent research has focused on documenting the existence and delineating characteristics of self-directed learning, while current research is focusing on identifying resources used by the learner, the quality of the learning, competencies needed to engage in SDL, and the conceptual meaning of this type of learning (Merriam and Caffarella, 1991). Additionally, determination of personality characteristics and SDL are being assessed.

Knox's Proficiency Theory

Proficiency theory is based upon a learner determining what he/she already knows and what he/she would to like to know. The theory posits "adult learning is motivated by a discrepancy between current and desired levels of proficiency" (Merriam, 1993, p. 10). Looking at the difference between existing knowledge and intended knowledge a learner determines the gap and addresses ways to fill the gap. This theory lends itself to adults because adults are better able to address the existence of a gap in knowledge. The determination of proficiency level is a task determined by the learner, unlike behaviorist learning where the instructor determines the gap and tries to fill it. In proficiency theory, the level of knowledge acquirement is at the discretion of the learner.

Mezirow's Transformational Learning Theory

Mezirow, Friere, and Daloz have assesses learning as process of change associated with knowing by use of critical reflections. Mezirow's work on transformational learning theory explains how adult learning is different from childhood learning. The major component that delineates a difference between adults and children is the critical reflection and awareness of "why we attach the meanings we do to reality" (Mezirow, 1981, p. 11). Mezirow's work, philosophically grounded in Habermas' ideas, is based upon adults being able to determine why they are learning. The conscious awareness that learning is taking place, and the awareness that learning needs to occur for some specific reason is important to his theory. Mezirow argues that learning because you are taught something and learning by recognizing why you are learning are two different things. Even though knowledge is

instilled in the learner, the recognition of importance is a factor that assists with retention and further knowledge creation. Thus learning is an intuitive, dialectic, and transpersonal process.

Summary

The four theories discussed above are not a comprehensive lists of all adult education theories, but provides the foundation for others works in adult education, as well as set the stages for which the author bases his instructional design decisions. A brief summary of principles or characteristics of these theories will help focus these design decisions. The key characteristics of adult learning theory are:

- Knowledge is created by the learner
- Learners are motivated to learn on their own
- Learning can still occur in traditional ways however self-directness will occur as a subject/discipline become more familiar to the learner
- Adults are self-directed
- Adults understand why they are learning and place importance on that learning
- Adult learners can determine their own proficiency level and existing gaps
- Adults can do their own needs assessment
- Individual experience of the world is important to learning
- Learning in not the discovery of independent, pre-existing knowledge but the construction of meaning through experience
- Learning is more subjective than objective
- Emphasis is on individual interpretation, integration and transformation of knowledge
- Knowledge is actively constructed by the learner, not passively received from the environment
- Learning is an interactive process

The above list is based upon the following antecedents about learning.
- Each individual is autonomous and desiring self-improvement
- Each individual has to have the capacity to be self-directed
- Each person is unique, and these individualistic differences are to be respected

Considerations of Adult Education Principles in Instructional Design

Since instructional design decisions are based upon beliefs about how learners learn, there are certain characteristics (described above) that must be considered when designing and developing instructional materials for adult learners. Because adults want to see the importance in the material they are learning, the instructional material must show them how this material will benefit them. Depending upon the stage of the learner in the subject matter (either introductory, advanced, or somewhere in between), the design must facilitate that level of learning. If students are new to the material then they must be acquainted with the subject matter and may be given instruction following a more teacher-directed, prescriptive approach. However, if this material is advanced or if the students already know about the subject matter (continuing education is an example), then the design must involve student-directed learning. This means many avenues or options for the students. Instead of a linear learning experience, the student should be offered numerous pathways to expand his/her own learning. In this setting the instructor (whether it be a computer software package as in CBT, or it be a teacher) needs to becomes more of a facilitator.

In learning situations students should be able to chose what level of proficiency they wish to acquire (learning will not occur if you force them to learn something they don't want to). Providing guidance will assist the student in making decisions about learning proficiency. Offering suggestions and providing alternate learning situations will foster the learning most appropriate to the self-direct learner. This becomes difficult in situations where employers must mandate some training, as most adults are not interested, nor are they motivated to learn something that they have not initiated on their own.

Students should be allowed to pursue different avenues of learning on the subject matter, however resources must also be available for students to advanced their own learning in directions they wish to pursue. In designing computer-based training, if other resources are not available (such as a dictionary of key terms or help

options) then the training encounter will not be a fruitful as possible had the resources been there. A lot of adults stay away from CBT because the different avenues are often not available, and the resources for aiding them through the instructional process are weak.

Besides these components, the right perspective on learning needs to occur. The outlined components of adult education theory are the foundation for which the author develops his instructional material. Keeping in mind these attributes assists the design process. All to often instructional designs follow a model and ignore the underlying basis for which the model was created. Using an instructional design model that reflects a different perspective of learning from that which one is creating leads to a mismatch in instructional goals. Creating a linear design when the students are interested in making choices results in an unsuccessful training program. This is where a good need assessment comes into play. Recognizing attributes and goals of the learners are one of the most important steps in designing instruction. If a directive need assessment is not possible, then look at underlying theory about how the learners tend to learn (i.e. adults prefer to learn one way while children may not be accustomed or prepared to learning in this manner).

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Practical Suggestions for Course Design, Collaborative Learning, and the Use of Library Resources in Web-based Instruction

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Abstract: This paper focuses on three selected Web-based Instruction issues, namely, course design, collaborative learning, and use of library resources from three viewpoints of three different professionals who have worked with WebCt—a professor, a graphics designer, and a librarian. The section on course design covers appropriate use of color and graphics, icons, non-linear designs, organization of articles in course notes, links, amount of information, and the like. Concepts such as intellectual property, copyright and fair use doctrines are covered in the section on the use of library resources. The next section on collaborative learning provides examples of collaborative activities which can help eliminate learners' sense of isolation and benefit learners both instructionally and socially. The impact of Web-based instruction on using library resources and digital materials is also mentioned.

Designing and delivering online instruction requires careful study and creative thinking in order to make use of the Web's potentials. Various issues need to take into consideration. A course designer has to be aware of design principles, the role of motivation, levels of collaboration and interaction, opportunities for providing students practice and reinforcement, distribution of support materials, management of student products, and assessment strategies.

This paper will focus on three selected Web-based instruction issues, namely, course design, collaborative learning, and use of library resources from three viewpoints of a professor, a graphics designer, and a university librarian. These three professionals have worked with WebCt, one of the popular Web Classroom Building programs designed for non-computer programmers for creating sophisticated Web-based courses. Since WebCt is platform independent, students can access their WebCt course materials using Web browsers such as Netscape or Internet Explorer from any Mac-based or Windows-based computer that is connected to the Internet anywhere in the world.

WebCt also provides a wide variety of tools and features for the course-building environment. Examples of tools include navigation tools, electronic mail, bulletin board, a conferencing system, online chat, student progress tracking, group project organization, student self-evaluation, grade maintenance and distribution, access control, timed quizzes, automatic index generation, course content searches and many more.

Data for this paper were derived from personal experience, informal interviews with course designers/instructors, review of related literature on Web teaching, and careful examination of ongoing online courses.

Course Design

As instructors use Web Classroom Building programs such as WebCt, there will be a need to carefully construct the interface and consider its impact on the instructional design of the online materials. Interface is the design of the Web page and how the students interacts with it.

These two sides of Internet course design are intertwined in a process of creating attractive, easily utilized Web pages for the effective delivery of instructional materials. Both aspects have particular qualities that must be addressed. In this new era of the World Wide Web, the size, shape and quality of the computer screen affect the interface design in ways not considered previously in print-based designs. The fact that the World Wide Web can be interactive, flexible and non-linear creates an interesting impact on the learner. The student can choose to interact with the instructional materials in unique ways which have not been tried before by the course designer/instructor.

The interface needs to be uncluttered, logical and attractive. Instructional Web pages must be clear in their intent. Each module or lesson segment needs to be titled and appropriately labeled. Students should be able to easily recognize what is expected of them and be able to navigate the site intuitively. The design should offer the choices of a non-linear design. This is a concept that students expect in Web pages.

The page also has to be visually interesting in order to keep the students' attention. (Khan, 1997). Always use appropriate graphics to highlight a page, especially humorous graphics. However, use photos judiciously. Large photos take time to load on dial-up connections. This is very important for students working from home. Use light-colored background and contrasting lettering. Keep text a very readable size. Survey the students about their computer's screen resolution and Web browser. These issues can affect how students are viewing the Web pages.

Concepts that apply to standard layout and design also apply to Web pages in broad terms. However, many new techniques have been developed that are unique to Web pages. Text can change colors and graphics can be animated. When the cursor is moved over an object, it can change into something new. Designers must take care to use these flashy techniques appropriately and in a timely manner. When these techniques such as blinking text or animated graphics are overused, the students can experience distraction and disorientation to the course materials, which is counterproductive to the learning process.

Icons for most utilized aspects of Web-based course such as WebCt should be arranged for easy access. In the opening interface, an icon's purpose should be clear. A class should be started with just a few work icons and then increased as the class progresses. Icons could be limited to allow students to become familiar with their purpose. The icons need to be in order of most used and most important. The syllabus may be most important the first week, but the course materials and calendar are more used as the course continues. A course can begin with the syllabus, biographies on the class, a calendar and course materials as possible basic icons and information with which to get started. The next session could include the bulletin board or chat room.

The course design should clearly show what the students will cover. Major sections may be constructed in a linear fashion, but within course chapters the use of non-linear designs that allow students to move freely among concepts can make the Web site seem more "friendly."

In the course notes, articles need to be organized into segments that are moderately long and easily read. If the student is required to scroll endlessly to read material, it can tire the learner. Restricting the page length to screen size or only slightly longer and then linking to the next concept or idea keeps the interest of the students and keeps them interactive with the material. Links from these pages open new windows to new information so the students have easy access back to WebCt.

Not only does the material needs to be well organized, but it also should be free of distractions that cause the students to become disoriented to the focus of the online materials. If a link merely connects to supplemental material, then the learners can be pulled away from the important information. Students can easily "surf" away from course pages and lose track of the course emphasis. That information could be placed in a special section for later consideration.

For discussion of course information, the bulletin board with threading capability is an organized, asynchronous conversation. Use smaller groups and specific forums to keep postings from getting so large. This keeps students from feeling lost in the larger class and not getting the opportunity to contribute. Specific forums allow the instructor to control the discussion direction. Some students would continue discussion indefinitely, so the instructor can limit discussions to a set period of time.

Other ways to keep the students' levels of interest high include varying the amount of materials to be covered in a week. Make some projects longer term and some assignments very short. This variety is a subtle way to keep course materials interesting.

The learners' perceptions of the class can be difficult if not impossible to gauge unless the instructor openly requests that information. Ask students regularly in a non-threatening way about how they feel the class is progressing. Set a particular forum for gripes about the class.

Use of Library Resources

The library should not be overlooked during the switch from traditional courses to Web-based courses. Adding supplementary materials to your Web site will make it more helpful to your students. Most colleges and universities have online library catalogs. A URL can be included in the online course so that students can check the library for books on a course-related topic.

Library homepages often have links to online databases that can be accessed from remote sites. Making the students aware of this resource is very helpful. Some schools have tutorials on searching and citing sources. This is particularly helpful for distance users. Also, many libraries have links to Web search engines like Yahoo! and AltaVista. The problem with using the Web is that anyone can be a publisher. The students should have some guidance in evaluating Internet sites by asking questions about the author, content, accuracy, and authenticity (McCormack & Jones,1998).

Sometimes you will want to include specific URLs or articles in your online course. The best rule is to ask permission for the materials that you are going to use. If you use a URL, you can contact the owner and ask for permission to use a link in your online course. If you plan to use an article, the best approach is to get permission. Wake Forest University School of Law in Winston-Salem, North Carolina, has a wonderful Web page that provides all the information needed to obtain permission. There is a sample permission form, a list of publishers, and information about how to obtain permission. Organizations or institutions do not usually tell you if you need to ask permission to use an article in your Web-based course, but a good rule of thumb is to ask after the first use (Hu, 1998). The other way to address this problem is to use the Copyright Clearance Center (Saunders, 1998). This organization charges a subscription fee and a copying fee for each article used. The fees vary because different journals charge different prices. The best way to handle this would be a college- or university-wide subscription and centralized office to keep track of the charges.

Copyright is in a state of flux. The Internet is a new format that is changing the traditional ways of teaching. Congress and the legal system do not have a definitive answer to this problem. The Digital Millenium Copyright Act and the Copyright Extension Act were signed into law in October 1998 by President Clinton. However, there are still issues to be dealt with under these laws.

The law requires the Register of Copyright to receive input from interested parties about how copyright will impact distance education and present the findings to Congress by May 1, 1999. A formal rulemaking procedure must be created to deal with access to a "particular class" of copyrighted materials. This will be conducted in the next two years before the DMCA goes into effect (ALA, 1998).

There seems to be a difference of opinions on how to deal with the problem of copyright. The best policy is to keep informed about what is going on in this area. The University of Texas has a Copyright Crash Course which is very informative (http://www.utsystem.edu). The Berkman Center for Internet & Society at Harvard Law School has a free cybercourse on intellectual property (http://cyber.harvard.edu) (Saunders, 1998).

The other controversial topic is who owns the course. Athabasca University in Canada was created in 1970 primarily to teach distance courses. The university claims rights to all courses the professors created and the university sells some of these courses to other schools. Until 1994 the faculty received 30% of the revenues from the courses. Then the university began keeping 75% of the revenues and gave the rest to the departments where the courses were produced. The faculty received nothing. As a result, the faculty

protested and the problem is currently under negotiation. If no agreement can be reached, the faculty will probably end up in court. The University of California at Los Angeles has made an agreement with a private company to run the online extension program. The original contract was criticized and is currently under review. As universities adopt a business model, these issues will become more problematic. The American Association of University Professors has published a report that states that a professor's course is the professor's property. One should check at your institution or system to see if an official intellectual property statement covers your online courses (Guernsey & Young, 1998b).

Collaborative Learning

Some Web-based instruction courses are designed to ignore collaborative learning while others are designed to promote it. Collaborative learning refers to instructional methods wherein learners work in pairs, small groups, or big groups to accomplish shared goals (Khan, 1997b).

One of the successful WebCT activities that promotes communication and collaboration was shared by one of our colleagues, Dr. Elizabeth Kirby, an instructional technology professor in the Department of Research, Media, and Technology at the State University of West Georgia College of Education. This debate activity using the WebCt chat room is described below.

The class consisted of 20 students in a Problems in Instructional Technology class. First, the professor posted notes for the students the week before the actual debate. The notes included the debate topic (e.g., "Should filters be used to control students' access to objectionable materials on the Internet?). Half of the class was assigned to argue in favor of filters and the other half argued against filters. The students were asked to read an assigned article about the filter issue which was available in full text in one of the online databases from Galileo, the WWW-based virtual library of the University System of Georgia. The students were also asked to read other related materials so that they would have a good, solid understanding of the issue. The list of references was to be submitted by each group after the debate. Next, the debate schedule, debate guidelines, team assignments, and room number were posted. An example of the guidelines is found below:

> The first 15 minutes of the debate (6:00 PM – 6:15 PM for Debate 1 and 7:15 PM –7:30 PM for Debate 2) will consist of an introduction and overview provided by the professor. Then you will have 5-10 minutes to meet with your group in a separate chat room. Then we will reconvene in Chat Room 1. At the conclusion of the orientation, we will have 30 minutes (6:15 PM – 6:45 PM, and 7:30 PM – 8:00 PM) of controlled debate. Controlled debate means that one person on the affirmative side will make an opening point. Then one person on the negative side will rebut that point and make a new point for the negative side. A person on the affirmative side will rebut the point raised by the negative side and will make a new point for the affirmative.
>
> For 30 minutes we will do a point/rebut and counterpoint debate interaction. This will be controlled because only one side (and one person from that side) will be allowed to speak at a time. We will use ellipses (....) and OVER protocol. We will also limit the length of interchanges. Each post should be limited to no more than 3-5 of the entry boxes that you get in the chat rooms. Each team will need to decide how to organize the communication flow so only one person is speaking at a time.
>
> The last 15 minutes (6:45 PM – 7:00 PM and 8:00 PM –8:15 PM) will be a less structured debate. At the beginning of this part, the instructor will ask each side to post a summary statement of the team's position. The summary statements from each team will be posted concurrently and should be no more than five entry boxes long. As soon as both sides have posted their summary statements, the floor will be thrown open. During this open phase, two people from each team can be talking at the same time to remake points that were made previously, to argue with the other side, or to make new points. There could be up to four people (two from each team) talking at the same time during this phase. The elipses (....) and OVER protocol will

still be used. The idea is to make this a more dynamic, fluid interchange and to work on your chat skills. There should never be more than two people from a team talking at the same time, so if two of the team mates are speaking or if you have something to add, you have to wait until one of you signals OVER. The professor will interrupt if the communication protocol rules are violated.

According to Professor Kirby, students' feedback on the debates was overwhelmingly positive. The students had learned how to debate effectively using the online chat feature. Another faculty from the same department, Dr. Margaret Roblyer, who teaches instructional design via WebCT, required students to critique one another's work using the WebCt bulletin board feature. Students first got together in groups via the WebCt chat rooms to design an appropriate peer evaluation form which would be used for this purpose. The evaluation form was then looked at and approved by the instructor before it was being used. After the critiques had been done by their peers, the students were expected to make changes and improve their work before submission to the professor.

One of the authors of this paper (Leticia Ekhaml) collaborated with outside speakers in her WebCt course. Arrangements were made by the professor with several speakers to come to the chat room at different dates and interact with the students on a given topic. The students were then asked to study more about a given topic and to read about the biographical data of each speaker either posted on the WebCt bulletin board or furnished on the speakers' Web sites. Each student was required to come up with two questions which should be sent via WebCt mail to the professor for approval. The professor then went over the questions, combined or refined the questions, and sometimes eliminated irrelevant or duplicate questions. Next, the students received the instructor's feedback about their submitted questions via Webct mail. Days before the speaker's chat session, ground rules about how the "ask the speaker" chat session should be conducted were given to the students via the WebCt bulletin board. For example, students were told that "typing in ellipses (......) means the person has not been done with typing yet. You should not interrupt."

Careful preparations that are made one or two weeks before the guest speaker's session always lead to an organized, orderly, structured, and meaningful chat session that is usually valued by the students. Collaborative learning increases students' motivation levels, eliminates their sense of isolation in online learning, and enhances the entire atmosphere of the online community.

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Creating Optimized Learning Environments: A Course using Interactive Web Elements

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Abstract: The use of the web for promoting learning provides great potential for both students and faculty. Using both synchronous and asynchronous interactions permits the professors and the students to maximize their time together and utilize their individual learning and presentation skills in a collaborative effort that yields substantial dividends in the form of learning and productivity. This presentation focuses on one course, "Reading in Content Areas", that is facilitated through the use of the interactive opportunities provided by the World Wide Web (WWW).

1. Introduction

The Vygotskian concept of the social nature of knowledge construction provides the main theoretical framework for the Web-based course we discuss in this paper. The constructivist approach of moving students from passive recipients to active designers of their own systems of learning coincides directly with the "learning to read – reading to learn" theme that guides the Content Area Reading course described herein. In addition, the Vygotskian view of the role of language in mediated discourse provides an excellent foundation for the examination of the relationship between content area reading, learning, and mediated discourse.

The course provides students with the following Web-based functions: 1) an interactive syllabus; 2) a threaded discussion group; 3) a private journal function; 4) web sites particular to the course; 5) class notes arranged by topics, including the instructor's PowerPoint presentations, with notes and web links embedded; 6) web quests that students in the present and former sections of the course design for their own and others' use; 7) an archive of past students' work; and 8) a form for submitting questions to the instructor and/or the technical support person.

2. Background

Wertsch & Bivens (1992) describe a "text mediational view" of the use of dialogic language as a means for making connections between "old" and "new" knowledge. In the text mediational view, students take a much more active role in negotiating both the meaning of the content as well as the structure and context in which the content is uncovered and examined. In essence, learning is a "mediated" transaction – one in which language serves as the moderator of the process. Rather than serving a purely didactic, information-processing function, language in the text mediational view provides a means for dynamic dialog to serve as the catalyst for the creation of new meanings and functions. The focus moves from transmission to social construction.

Equally informative for our work is Tharp and Gallimore's (1988) concept of "instructional conversations" as a means of providing students with situations in which a text mediational view may flourish. Ordinary classroom discourse, to say nothing of college lectures, is generally not characterized by a discernible level of peer-driven dialog. In fact, it seems the direct instruction/lecture model utilized in most typical university classrooms rarely leads to a socially-negotiated knowledge base. Students in such environments typically are not engaged in bringing to bear their existing personal and/or professional knowledge – combined with the perspectives of their peers – to form a new, negotiated palette of meanings to carry with them into their own classrooms. Realizing this, and in search of an alternative perspective for this course, we have drawn on a combination of the *text mediational view* and *instructional conversations* to provide the foundation of the web-based learning environment described in this paper. The result has fulfilled on its promise of an environment in which the creation of shared knowledge is inherently fostered and continuously recognized as paramount by both the students and the instructor.

3. Specific Course Components and their Uses

3.1 The Syllabus

The syllabus of "Content Area Reading" explains the requirements and contents of the course, and in addition provides several web links. The first of these is the link to the web site of the course textbook, *Content Area Reading*, by Richard and Jo Anne Vacca (1999). Here the students find chapter outlines and guides (activities, learning logs, and web page links related to the topic of each chapter) as well as "Content Area Links," an index of teacher resources on line.

Within the syllabus students also find a link that allows them to create a profile of themselves, and thus to "register" themselves for the interactive elements of the course. Once they do this, they can participate in the course discussion and electronic journal features of the course. The syllabus also contains links to instructions for the web quest requirement of the course, along with instructions for downloading the latest version of Netscape Communicator that includes a simple web page authoring tool, Page Composer.

3.2 The Discussion Group

The course discussion group is an online threaded discussion in which all students participate. Though the professor does not usually contribute to this, he is able to monitor the discussion and respond to individuals or the group via the discussion or in class. Students choose the topics of their discussion, and these are usually related to an issue that is brought up in class. As a starter for the semester, each student is asked to make a first entry on the topic, "Why I am taking this course." From that point onward, the discussion meanders as most discussions do, taking on a life somewhat of its own. Depending on the number of students enrolled in the course, and their particular preferences, discussion participation will vary in intensity semester to semester. The discussion group is visible to those who are not taking the course; however, participation is limited only to those students currently enrolled in the class. Enrolled students use their unique usernames and passwords to make postings to the discussion group.

3.3 The Journals

Students make entries to their journals once or twice a week. They are instructed to use the journal as a record of reflections and reactions to the course that only they and the professor will access. When a student posts an entry, the professor receives an automatically generated e-mail message that notifies him of the post. Within 24 hours, he opens the student's journal, reads the latest post, and replies via the e-mail note. This avoids the tendency to let student journals pile up as with paper copy that has to be read en masse at the end of each semester. It also insures a continuous flow of feed back and response between professor and student. The final journal entry for each student is a required self-evaluation in terms of the individual's goals in taking the course.

3.4 Course Web Sites

An index of course web sites is provided, including 1) the web site for the textbook, 2) Kathy Schrock's home page, and 3) a locally maintained site called The Content Literacy Information Consortium (CLIC), with hundreds of content-specific, on-line resources, as well as professional organizations, journal articles and various other instructional artifacts. The latter is also a site to which students may add on-line resources as they find them and wish to share with others.

3.5 Class Notes

This link provides access to the professor's notes for each class session, created in MS Power Point and saved in HTML format, including notes on each slide. Slides often contain hypertext links related to the topic and links to electronic reserves placed on line by the instructor. The class meets in a computer lab where at the beginning of each class session, students access the course web page, turn to class notes, and open the notes for the day. They then use a process of think, pair, and share to think about each slide/notes combination, pair up with a partner to compare their own notes made on the Power Point handouts page, and share ideas with the whole class. The class discussion centers on the questions and comments of the students in response to the notes. More often than not, students seem to forget or ignore the author of the notes and react to the ideas in the abstract. This can create a much richer class discussion than if the students were responding to a lecture.

3.6 Web Quests

Web quests are created by the students using the model and template provided by Bernie Dodge (the creator of Web Quests). Each student creates a professional web quest for teachers and a student web quest on a topic of their own choice for classroom use. These are posted on the class web page as they are completed, usually near the end of the semester, and each semester's work is archived and accessible for later use. The motivation for this requirement is based in the conviction that, increasingly, "reading in content areas" will be defined by access to topics of the curriculum on the web. One can envision the day when the entire curriculum of American high schools is cast in the form of web quests, requiring reading and study of multiple sources in study of all content to meets the demands of criterion-based curriculum. When that day comes, student who have experienced courses such as the one described here will be prepared to guide their students in the use of the web in pursuit of knowledge and understanding.

4. Discussion and Evaluation

4.1 Mode of Inquiry

Each semester, class participants are asked to submit a self-evaluation describing personal learning outcomes as a result of the course. Also, each submits a course evaluation, from which much useful information is drawn. Finally, the authors read the journal entries and analyzed the discussion group strands, looking for themes and categories that emerged from the course experience, as well as relationships between categories that become apparent.

4.2 Data Sources

The primary data sources for this study were the students' on-line journals, the evaluation reports, and interviews conducted by the authors. The students in the course are primarily graduate-level students seeking a master's degree in reading education. However, the students do represent a wide variety of content areas. Most are in-service teachers, though a few are not currently in a classroom, and there are occasionally one or two who have yet to complete their student teaching experience. Each of the students submits a self-evaluation, as well as a standardized course evaluation.

4.3 Results

The data analysis presented several emergent themes and categories that appeared throughout as a result of the web-based learning environment. First, a strong *community of emergent professionals* develops in the course as a result of the web-based discussion group. Second, the experience with the web-based learning environment results in a level of *instructor development* that, according to the instructor, would have been much less likely without the experience. Third, both the instructor and the students report a higher degree of development of *student-instructor relationships* as a result of the web-based learning experience. Fourth, the web-based environment fosters an increase in the *maintenance and sustenance of conversations across time* – rather than the initial belief of sustenance over distance – though distance was also addressed. Fifth, there still exists a strong sense of fear where technology and instruction are concerned, and for a few students this web-based experience did little to allay those fears. Finally, there appears to be a strong relationship between the student-instructor relationships and the instructor development resulting from the course experience. This relationship seems to provide the foundation for a higher degree of professional development for the students and a higher level of teaching from the instructor.

Community of Emergent Professionals

Perhaps the most interesting--and compelling--outcome of this course has been the development of a professional community of like-minded peers that seems to emerge with each group. The course discussion group seems to be the strongest catalyst for this. As evidenced by the following student's comment, it appears that the type of dialog enabled allows for a level of professional growth that may otherwise be missed:

> Thanks to the listservs and our own class homepage, I have been able to exchange ideas with my peers. This is the first time I have been able to do so because I don't live near campus. I feel that these discussions have greatly enhanced my participation in the broadening of our group "mind". Up to this point, I have only had brief discussions during breaks or on the way to the parking lot after class. By then, my main goal has been getting home. I think that every class should either have a discussion page or at least have access to such a page. This would help students who commute and students who are physically challenged.

Not all discourse opportunities held equal appeal with all students. Some preferred journaling, while others preferred the more community-based dialog:

> These are the areas on which I am basing my self-evaluation: (A) attendance & participation in class discussions; (B) participation in discussion group on the computer; (C) participation in the Read-L discussion group…this is how I would rate myself: (A)5; (B)5; (C)3 (I participated by reading and thinking about the ideas, but I chose not to enter the discourse) …

It is interesting that this particular student--a fairly active contributor to the course discussion group--chose *not* to participate in the READ-L listserv, a more distributed mechanism that included content area reading students from several other universities.

Instructor Development

The motivation for the turn to technology in this course lay in the dissatisfaction of the instructor with the effect he was getting from business as usual. PowerPoint presentations were fine, but they ultimately presented old content in new wrappings. How could anyone advocate for literacy in a community of cooperative learners from behind a lectern? So the leap was taken, and the restructured course began to move more toward transaction and away from transmission. But transactions are double-edged, and the first change to be noticed was not in the students but in the teacher. Half way through the first semester, struggling daily to upgrade, reform, and expand the

course with technology, one remark from the professor summed up the early effects: "I don't know if this is creating a better class, but I do know it's making me a better teacher."

Student-Instructor Relationships

The proof of this was to come later, near the end of the course when students were asked to comment on the course from their side of the desks. Comments like the following cast brighter light on the effects the instructor was getting:

> I soon found out that Dr. Estes was instructing us in a way that he hopes we might instruct our students. What better way to learn about a method than to experience it for oneself! While it did take me awhile to get myself going, once I found some direction, I was very motivated to put the time into this course because I was in charge!

> The content was extremely challenging, (but) if I hadn't taken this course I would not know nearly as much as I do now about the internet. I never realized the importance of technology and the World Wide Web in my classroom before this class. Very important for teaching in today's classrooms! Every teacher should take this course!

> On a personal note, Tom, this class has been wonderful for me and I truly enjoyed it. I have a new enthusiasm for the teaching of reading, as well as a new outlook on what reading is. It is beyond the word calling and skills I grew up with and taught the first 6 years of my teaching career. I thank you for sharing it with me.

Conversations over Time

The original impetus for creating an area on the course web site for discussions was to extend those discussions across space. We anticipated that students would engage in more meaningful dialog if they could converse with peers and with the instructor from home or work. Interestingly, more students reacted to the opportunity to engage in more longitudinal discussions as the more attractive aspect of the discussion group, as evidenced by the following students' comments:

> I have just spent some time going through lines of discussion on the discussion group. I feel that this is a good use of the computer and my time. In a way, I feel that it extends my class time.

and

> The discussion group was a useful way to communicate with peers outside of class and keep conversations going about various topics related to class.

In fact, a number of students requested (and received) permission to participate in the current conversations, even after they were no longer enrolled in the course:

> I participated in the Content Area Discussion Group when I could add anything useful. I will miss reading and sharing ideas with this class. They all have so much to add from their various backgrounds. How long will this discussion page be available? I need to make notes of various suggested web sites to keep in my personal book I am creating with the web sites suggested by our class. Will you do this again? I would like to continue "listening in" on the discussions.

Frustration

Although the results presented in this paper seem to suggest a generally successful experience, it is important to note that frustration with the technology and with the process itself

certainly exists among participants. Issues of access, expertise, availability, and ease-of-use are still common and serve as barriers to some students. Whereas the majority of students are able to persevere, some have more difficulty than others--and some are more successful than others. As one student offered:

> My internet project was designed to familiarize myself with the internet so I felt comfortable "surfing". I had to overcome a lot of frustration in fulfilling this requirement because as a newcomer to the Internet I couldn't ever seem to get anywhere.

4.0 Educational Importance

Students in grade school and high school today take the computer for granted, and many, if not most, use the World-Wide Web as a source of information in their research and study at least some of the time. Teachers, by contrast, often do not recognize the value of the Web as a source of information. A new generation gap has arisen as a byproduct of the age of information technology. A content area reading course seemed the ideal place to begin to close that gap. The goals of the course include developing techniques to help students close the gap between the potential of the computer and its realization by most teachers. Many of the graduate students in this course were only marginally facile with technology at the start. By the end of the course, virtually all do adopt the computer, and specifically the Web, as a tool for both their own teaching and their students' learning. For most, this course forces a remarkable paradigm shift that will affect teachers' practice to the ends of their careers.

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A Classroom View: A Tool for Professional Development

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Abstract: Teacher preparation for technology integration into education requires not only compelling approaches but also just-in-time exposure to new ideas, methods, and models. *A Classroom View: A Tool for Professional Development* is an interactive CD-ROM that has been developed to support the professional development of inservice and preservice teachers. *A Classroom View* permits educators to explore diverse video-cases focusing on technology-supported classrooms. The powerful video content of this package enables educators to "journey" to far away classrooms at their own pace, observe interactions, situations, and "visit" with teachers to learn more about how they feel and how they go about the technology as-a-tool integration process. The naturalistic video-cases describe, in the context of class projects, how technology (a) is used to enhance teaching and learning; (b) reinforces students' acquisition and applications a new knowledge and skills; (c) facilitates students' expression of ideas; and (d) increases students' motivation, engagement, and communication.

Traditional vs. New

The future demands that our children graduate with skills that prepare them to be productive by either joining the competitive marketplace or advancing to higher levels of education and training. School districts that recognize the essential role that technology plays in today's world are committed to prepare all students to function in an increasingly complex and information-rich world.

Traditional instructional strategies and methods support behaviorism, mastery learning and classrooms depicting teacher-centered instruction, information delivery, passive learning, isolated work, and artificial content. In contrast, new digital tools support constructivist approaches and create new environments to enable learners to construct their own knowledge. Such technology-supported environments provide student-centered learning, information exchange, active learning, collaborative work, and real-world problems. In a student-centered classroom students play new roles (Fabris, 1996). The learners become:

- Effective users of productive tools
- Inquires and information seekers
- Analyzers and evaluators
- Problem solvers and decision-makers
- Communicators, collaborators, publishers and producers
- Informed, responsible, and productive citizens

Educators who recognize technology's potential create effective conditions for new teaching and learning. These teachers/innovators provide us with inspiration, leadership, and an array of powerful examples of notable practices to guide other educators during the technology implementation process.

The Purpose

The purpose of our undertaking was threefold:

To **help** educators understand and learn about what happens in the classroom when teachers and students have access to technology,
To **design** a program that supports professional development and facilitates the implementation of technology across the curriculum, and
To **create** a prototype for the development of future professional competency modules

The First Module: Word Processing

First, we envisioned an alternative context for professional development based on the Cognitive Flexibility Theory (Spiro et al. 1988, 1990, and 1991) which proposes using hypermedia to explore ill-structured domains. Next, we developed *A Classroom View: A Tool for Professional Development* that uses hypertext and multimedia components to enable learners to explore the video and text content in a variety of ways and from different perspectives.

Video-cases (Risko, 1995) play a pivotal role in the design and development of hypertext environments. Furthermore, hypertext and hypermedia provide ways to explore complex concepts following different paths, facilitating the understanding of distinct variables that affect the multidimensional technology implementation process. By design, *A Classroom View: A Tool for Professional Development* is flexible and interactive, allowing educators to use the CD-ROM in many different ways. The package does not offer specific "recipes" of how to use technology, but rather a framework supported by a collection of naturalistic video-cases of PK-12 technology-supported classrooms. *A Classroom View: A Tool for Professional Development* content and format prompt users to:

- Visit multiple classroom at their own pace
- Observe and reflect on a variety of teaching strategies and techniques
- Analyze different components of exemplary teaching episodes
- Study classroom dynamics, situations, and interactions
- View the use of technological tools to support learning through, research, composition, collaboration, and communication
- Examine technology implementation in the content of meaningful examples, activities, and projects

Although the project's earliest efforts were directed to create a simple word processing module, it evolved into an extensive interactive package, which shows multiple video examples focusing on proven learning practices and technology-supported lessons. The project emerges as a multimedia showcase of "integration" across the curriculum in the context of both the four stages of technology integration and the four academic levels. Four stages and four academic levels result in a 4 by 4 grid that provide a basic framework and facilitate the organization of the multimedia components.

The Components of the Model

A Classroom View: A Tool for Professional Development has three main components: (a) the **Command Center**, an interactive guide and tutorial that delineates all major elements; (b) **Academic Levels** and Host Classrooms scenarios; and (c) **the Stages of Technology Integration** strand.

Command Center
The Command Center includes sequential segments in video, audio, and text format that define terms and that describe the interface and navigation scheme. The user can view the guide linearly or pick selected items.

Academic Levels
There are four Academic Levels represented in the model: Primary, Elementary, Middle and High School. These are referred to as the Host Classrooms. The Host Classrooms scenarios present diverse examples of word

processing implementation organized around the units of practice (UOP). The sixteen main technology-enhanced lessons incorporate the following video-cases:

Product - Depicts, in video format, samples of student products created during the lesson
Invitation - Shows teachers explaining what motivates them to present the unit
Situations - Illustrate where activities take place, how technology is arranged, and the time frame for the projects
Interactions - Demonstrate the grouping arrangements: individually, in small groups, or whole class
Tasks - Delineate what projects, research, and other activities the students are asked to do
Assessment - Highlights the criteria by which the student's work is evaluated
Reflections - Summarize the teacher's learning experience while working during the unit

Snapshots and Teacher Reflections. A brief text and audio snapshot introduces the scenario at each academic level. In addition, text for reflection complements each video-case and outlines the teachers and students' learning experiences while working throughout the lesson. What follows are snapshots that describe four lessons conducted by Ms. Vanessa Jones, a fourth grade teacher.

Instructional focus of lesson one: To stimulate the students to think and write by looking at nature in many different ways, developing detail, and discussing ideas. ***Technology concern:*** learning basic skills ***Assignment:*** simple text entry.

Snapshot - The students take a nature walk, collect item that are found in nature, and create their own similes about nature using word processing to type imaginative one sentence captions. The classroom similes are incorporated into a big book about nature.

Instructional focus of lesson two: To introduce diverse genres of literature to the students and motivate them to write more creatively. ***Technology concern:*** taking control, getting organized, basic productivity. ***Assignment:*** whole class assignment.

Snapshot - As the teacher becomes skilled with technology, she creates class assignments that require more organization and more technology use from her students. This unit brings the imagination of students to life in fairy tales, creative writing and presentations for a variety of purposes and audiences.

Instructional focus of lesson three: To introduce the students to the use of persuasive writing by supporting a point of view, and adding interesting and realistic details. ***Technology concern:*** revising, proofreading, and communicating including multimedia ***Assignment:*** group projects.

Snapshot - The students work in-groups taking on different roles and activities. They use word processing differently, as they begin to use the computers to create and edit their work as opposed to making simple text entry. In a persuasive writing project, students reach out for a variety of tools and resources to rewrite the book *Doctor De Soto*.

Instructional Focus of lesson four: To expose students to real world experiences and give them the opportunity to develop analytical skills throughout an interdisciplinary project. ***Technology concern:*** advanced levels of productivity, use of tools to communicate ideas, solve real world problems. ***Assignment:*** simulate a company and create multiple business documents (new interactions and environment, community connections).

Snapshot - In this unique learning experience the students reach out to the community for advice and expertise in creating airplane companies. The products designed by the students reflect a true interest in problem solving in the real world. The students use the Internet as a research tool and word processing to organize and present information about their fictitious companies.

These scenarios illustrate a growing process, indeed an evolution (Sandholtz et al., 1996). The classrooms begin at the novice stage by using word processing to write "one sentence captions" to a later phase where technology truly becomes a real world productivity tool.

Stages of Technology Integration
There are four Stages of Technology Integration describing the way users go about the technology implementation and integration process. This paradigm emerged from the Apple Classrooms of Tomorrow (ACOT) research model. According to Sandholtz et al. (1996), there are five Stages of Instructional Evolution: entry, adoption, adaptation, appropriation and invention. Our team adopted a model of four Stages of Technology Integration: Anticipating Change (novice), Taking Control, Extending Your Reach, and Creating New Worlds (advanced). These are no discrete steps but a gradual process of development and change that take place in the classroom during technology implementation.

Anticipating Change - First Stage. At the Anticipating Change of Technology Integration, teachers feel overwhelmed, yet interested about the potential of technology. Teachers and students create, save, print, and edit simple documents for the first time.

> "When I first got involved with computers, like everybody else who is my age, I really didn't even have the confidence to turn them on... they were so sacred I don't think I was convinced that I could use them effectively with kids." (Carolyn Crouchet, First Grade Teacher, Personal Communication, 1998)

> "When I first got a computer in my classroom, I was really scared to use it. I was afraid that I was going to break it, or jam it, or freeze it up... and I will be without a computer. I spent a lot of time just experimenting, doing a lot of hands-on... I lost a lot of documents, but I learned from experience." (Vanessa Jones, Fourth Grade Teacher, Personal Communication, 1998)

Taking Control - Second Stage. At the Taking Control Stage, teachers organize their classroom in various ways to make efficient use of the available resources. Teachers use technology to engage and motivate students. Teachers and students use computers as productive tools for papers, research, and communications.

> "I've organized my classroom in lots of ways to use the computers more efficiently also to maximize my time more efficiently and the process has grown over the years." (Carolyn Crouchet, First Grade Teacher, Personal Communication, 1998)

> "My classroom is an open concept classroom. We do not have very many walls, but the one wall I do have... I have the four computers lined against it. I have the kids working in groups of two, one person working on their letter and another person being their helper, their editor, their tech support person right beside him." (Marva Solomon, Third Grade Teacher, Personal Communication, 1998)

Extending Your Reach - Third Stage. At the Extending Your Reach Stage, classroom environments change, and teachers' roles adjust to accept and capitalize on students' leadership and skills. Teachers and students become proficient at using various programs to create multiple files and to complete group projects using several resources, including multimedia.

> "My students are a source for ideas for me. From my students via technology and also via other things they learn, I've learned that the top end is higher than I would have even guessed, and I have pretty high expectations for young learners. But I've been really surprised. It's such a powerful motivator, so technology usage really promotes literacy with young kids, and literacy on a much higher level than I would have expected." (Carolyn Crouchet, First Grade Teacher, Personal Communication, 1998)

> "New ideas from the students are kind of interesting to me in that... a real creative kid will come up with a little project and them he himself or she will suggest that maybe this will be something I can use with my other classes. They said, you know... what you may do is suggest that the other kids be able to watch our projects and critique them, tell us what are we doing wrong, tell us what they don't understand, so we can clean them up." (Max Fisher, High School Teacher, Personal Communication, 1998)

Creating New Worlds - Fourth Stage. At the Creating New Worlds Stage, a new curriculum emerges. Technology alters classroom dynamics shaping the way teachers and students approach teaching and learning. The teachers themselves rethink the way they go about teaching and learning.

Teachers and students use technology to work cooperatively and collaboratively with peers, community, and others around the world. Learning is active and student-centered. Students create inspiring projects and share their learning, explore community issues, and communicate their discoveries. Technology resources become just tools for inquiry, information exchange, problem solving, critical thinking, and reflection.

> "But things really have substantively changed. Technology has helped support a change in education for me and for my students. My kids see themselves often as the teacher. They often will find particularly research things that are exciting to them. When they find sites when we have exploration time and they find sites on the Web for different science pieces that interest them, it's often at a higher level than I would have anticipated. So I find, okay, they can teach me some things that I can teach the rest of the class." (Carolyn Crouchet, First Grade Teacher, Personal Communication, 1998)

> "School started becoming a lot more fun with this inclusion of technology... and letting go... the teacher as instructor kind of model into a more student-led intentional learning. And that has been one of the biggest rewards of incorporating technology. I am not longer the expert, nor the center of focus, but I am more a resource... and learning to use kids as resources." (David Matthews, Middle School Teacher, Personal Communication, 1998)

Teachers involved in this study were asked to reflect on their practices. To this end, they provided candid narrative about their instructional experiences in their classrooms as well as statements of personal triumphs and frustrations. They described technology-supported instructional events and issues, how they grew comfortable with technology, their transition to facilitators rather than in traditional roles, and how technology transformed their approaches to teaching and learning.

Strengths and Limitations of the Model

A Classroom View: A Tool for Professional Development deepens the understanding of how technology is used to enhance teaching and learning. Moreover, it exemplifies how, under the right conditions, technology can be a powerful, effective learning tool. In addition, the package's random access facilitates observation and reflection and provides a fertile arena for inquiry offering useful insights into how technology affects teaching and learning by showing concrete examples of:

- how teachers use technology to create challenging environments,
- what happens when students use the digital tools for building their own knowledge,
- the evolution of the teachers' beliefs and practices, and
- how both teachers and students move throughout the stages.

Nevertheless, the role technology plays in education is multifold and very complex. A study such as this, which focuses only on the role of word processing, is only one dimension of the complex technology integration process.

To help the community of educators move forward in the implementation process requires not only updated technical resources but also right conditions and a teacher's in-depth understanding of the multiple variables involved in the process.

Conclusion

How have we accomplished our goal? We created *A Classroom View: A Tool for Professional Development*, to:

- Prompt educators to examine assorted strategies
- Provoke educators to reflect on their actual practices

- Motivate teachers to explore new ways to integrate today's digital tools across the curriculum
- Guide educators to incorporate new strategies for diverse learning styles
- Encourage educators to develop alternative modes of doing instruction
- Influence educators to explore more constructivist approaches to teaching
- Help educators plan for change
- Induce a change in beliefs about teaching and learning

Feedback received from stakeholders, technology facilitators, and practitioners have been very encouraging. We are confident the model will assist and benefit many more educators.

The Future

The next step for our team is to refine the actual model and interface and to create similar modules for other professional competencies. Plans for the future include the delivery of a new generation of multimedia modules using our Intranet.

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Student Teachers as Instructional Designers: A First Experience

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Participatory Design, which enlists the end-users of computer programs in the project design, was the cornerstone for a study conducted with students teachers involved in their first computer skills course. Under the guidance of the instructional designer/researcher, student teachers were given the task of designing the class tutorial for word processing skills encountered in the course.

Utilizing a participatory, recursive design process (Schuler & Namioka, 1993), in which small groups were organized to provide product design input, the instructional designer/researcher constructed the tutorial in HyperStudio per design specifications provided by the student teachers, which was then critiqued by the whole group. The recursive design process continued, incorporating changes that the student designers required, until whole group feedback sessions indicated product satisfaction. The documentation of the evolution of sophistication of student product in relation to increasing computer skill competencies is apparent in the end product, *Word Processing Wizardry*.

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CLASS WEB SITES: A DESIGN MODEL

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Abstract: Many instructors are taking advantage of the Internet and creating Web pages. In this study an analysis of instructor-generated Web pages was conducted in order to capture key structural and content components with the intent of improving the effectiveness of this format. An evaluation instrument was created to identify exemplary web sites using the following variables: content, presentation features, and design appeal. One hundred fifty instructor web sites were selected and independently assessed by ten evaluators. The culmination of this study was the construction of guidelines for training post-secondary instructors on how to maximize the use of this Web-based resource.

Introduction

Many advocates of the Internet are excited about the teaching potential of the World Wide Web (Web) and there is widespread interest in incorporating the Internet into education. Much effort and many resources are being directed toward getting Internet connectivity to teachers and students. As an example, The Condition of Education 1998 reports that between 1994 and 1997 Internet access in public schools increased from 35 to 78 percent. However, creating Web sites is very different from publishing printed documents. Instructors must understand and evaluate the strengths and weakness of the medium as well as master Web page design techniques to achieve useful and productive Web sites for their students.

In this study, an analysis of instructor-generated Web pages was conducted in order to capture key structural and content components with the intent of improving the effectiveness of this format. There were three components to the research methodology. The first required the assistance of 10 volunteers who evaluated the presentation features of pre-selected instructor-generated Web sites. The second component involved a survey of the instructors who had generated the evaluated Web sites. The third component entailed examining and comparing the exemplary Web sites in an effort to assimilate and propose guidelines for developing Web sites that incorporate these components and presentation features.

Evaluation of Presentation Features

Each Web site was evaluated and scored by ten independent evaluators. The evaluators represented the general public, potential employers, students, and colleagues who might have an interest in instructor Web pages. Using a Web page evaluation instrument, the evaluators visited 150 pre-selected Web sites and completed an evaluation sheet for each site. The first fourteen items required the evaluators to locate various presentation features and to rate them using the following scale:

1 Presentation feature was not there
2 Found it, but had to look for it
3 Fairly easy to find
4 Obvious
5 Not only obvious, it looked great too!

The remaining items were written as a statement and the evaluators rated each item on a scale between "strongly disagree" and "strongly agree." The option "not applicable" was available for those features that could not be found. The evaluated items were totaled to give each Web site an overall score. A frequency procedure was run on all the scores to determine their means and medians. The Web sites were than ranked based on their overall score. The scores that were one standard deviation above the mean were ranked as "exemplary," the scores that were one standard deviation below were ranked "poor," and the rest were ranked "average."

Using SPSS, a Mann-Whitney U test was run on each evaluated Web page feature. The Mann-Whitney U tests the null hypothesis that there is no difference between exemplary and average Web pages in the mean ranking of the rated presentation features. Because multiple comparisons were made, Bonferroni post hoc tests were also done to confirm significant differences among the ranked items. With regard to inter-evaluator reliability, there was a majority consensus among the evaluators on 78.1 percent of the evaluated items.

Exemplary Web sites had higher mean ranks and poor Web sites had lower mean ranks for the following features:

- An identification of the school
- The listed "update date" was less than six months old
- Links to other relevant sites
- Information that appeared accurate
- Pleasing use of color
- Appropriate use of graphics
- Content that was easy to read
- Working links to other sites
- Functional use of tables
- A table of contents
- A site that was fun, inviting and captivating
- A site that had personality
- A site that was original and innovative

Optimal Configuration of Web Page Components

Instructor-generated Web sites are informational in nature. Unlike commercial Web sites, there is no need to gain the attention of the consumer for the purpose of a selling product. Instead they need to convey information coherently, which requires that the Web site be organized and functionally designed.

Being organized means providing identification on Web pages that let users know where they are and what they are reading. This was especially important if users were linked to a Web page that wasn't the site's home page. In this study, not having any identification on the Web site was deadly. Web sites without an identification of the school, class, or author always received a poor ranking from the evaluators. Other elements that reduced a ranking of Web sites from average to poor included missing e-mail addresses, "last updated" dates, and lists of credits. Putting these elements in a Web site didn't necessarily move Web site rankings from average to exemplary.

Elements that improved Web site rankings from average to exemplary included: a visitor counter, information that was useful for its intended audience, use of some animation, navigation links, appropriate and functional frames with an alternative option not to use them. Web sites that contained working links to other relevant sites were consistently rated higher than those who didn't. The sites that included navigation links also scored higher, but not having them didn't necessarily move the ranking from average to poor. This was true of animation as well. Exemplary Web sites tended to have layouts that were easy to read, tables of contents, and visitor counters while poor Web sites did not include these features.

Some evaluated Web page features didn't make a significant difference in the Web site rankings. For example, using a meta tag made no difference in how Web sites were rated, which was just as well as most of the instructors didn't know what they were anyway. Other elements that did not make a difference included statements of purpose, identification of the intended audience, and the use of sound or video.

The results of this study show that Web sites that were fun, inviting, captivating, original and innovative can make or break a Web site rating. However, information that appeared useful for its intended audience also improved Web site rankings. Perhaps an average site that is useful to its intended users is, in

itself, a worthy goal. It is important to remember that content is the most important aspect in an instructor-generated Web site and students will overlook bad format if the site contains a wealth of useful information.

Web Site Design Guidelines

The primary application of this research is that it can serve as basis for structuring an in-service presentation to instructors regarding Web site creation. The following outline is recommended for conducting workshops. Each topic can be expanded upon for novice Web page authors, or summarized for a more experienced audience.

I. Planning
   A. Set goals for the site - Identify what is to be accomplished with the Web site. Create a clear statement of purpose and objectives for the site.
   B. Identify the audience - Identify the potential users so that the site can be designed to meet their needs and expectations.
   C. Identify the content - Content should be meaningful and important to the intended audience. It should also be accurate, complete, and current.
   D. Identify resources - Besides personal preference, resource choices may be limited because of institutional partiality, cost, available assistance, hardware and/or software limitations. However, decisions must be made up-front regarding what will be used for the following resources:
      i. Web browser - A wide array of Web browsers are available for just about every platform, including Microsoft Internet Explorer and several versions of Netscape. Take into consideration which browser may be used by the intended audience.
      ii. HTML editor - Choices include text editors or HTML editors. Some editors are easier to use than others. Take into consideration the computer literacy level of the Web author.
      iii. Web server - Identify where the web documents will be stored. Many schools provide space on their network server for instructor-generated Web pages. However, some schools have restrictions and/or requirements that must be heeded. Another option is to use a private Internet Service Provider.

II. Information Requirements
   A. Gather existing documents - Collect the course material that is currently being used and could potentially be content for posting on the Web site.
      i. Hard copy - If all the documents are only on paper, it will need to be typed and saved as a text-only document.
      ii. Text file - If the material is on disk, as a word-processed document, then it will need to be saved as a text-only document.
   B. Decide on content - Content can be anything the author wants to put on the Web site. It could include current handouts, interactive exams, archived documents, pictures or other personal information.
      i. Use current documents - In some cases this information will already exist in some non-hypertext form. Converting a word-processed document into an HTML format is often the quickest way to place content into Web pages.
      ii. Create from scratch - Occasionally it is more appropriate to write the document from scratch in order to take full advantage of the hypermedia format.
   C. Draw site plan - Sketch out an overview of the Web site. The purpose of the sketch is to help the author visualize the entire Web site and how it will look when it is complete. At this point, the Web author can decide what content will go on what pages and how the navigation links will connect the pages together.
   D. Discuss how HTML works - HTML tags specify the form, substance, and function of hypertext documents. Start with basic tags for creating text, in-line images, and hypertext links. Later move on to more advanced page formatting such as lists, tables, and frames.
   E. Decide on Editor - Many software tools are now available to aid authors in the creation of Web documents.
      i. Text Editor - Writing an HTML source document with text editor, i.e., Notepad or WordPad, is as easy as editing the source code, saving the file with the appropriate

HTML extension, and viewing the results with a browser. While simple, it is somewhat tedious and easy to make mistakes.

ii. HTML Editor - HTML editors assist in the task of writing HTML code by reducing the number of keystrokes, providing "what you see is what you get" (WYSIWYG) editing, and with some, syntax checking. Many are free to educators. However, some are complicated and difficult to learn.

F. Decide on Coding Method - A Web author can chose from any of the following options for creating Web pages:

i. Code from scratch - Because HTML coding is fairly easy and straightforward, many Web authors start with this method. It gives the author an opportunity to better understand how HTML tags function and all that is required is a text editor.

ii. "Borrow" code - Users have free and open access to look at HTML source code and HTML files are easily displayed with any text editor. Using the copy and paste capability of Windows, a Web author can copy the source code of any Web page that closely resembles what the author is trying to achieve.

iii. Use a template - Many schools provide their faculty with a template Web page to assist in the Web design process. This helps to ensure a minimum design standard among Web pages and encourages faculty to create Web sites. There are also many free templates available on the Web with color-coordinated graphics and backgrounds.

III. General Design

A. Design Considerations - Follow a simple and consistent design. A consistent design will let the readers concentrate on content.

i. Common look and feel - Users should be able to recognize the pages of a given site. This can be accomplished by incorporating into the Web design the following items:

a. Common header elements - Page identification and navigation bar.

b. Common footer elements - The footer of a document usually includes a copyright notice, address of the developer, and designated contact person. On longer pages, this includes the navigation bar as well.

c. Common graphics style - Provide a uniform and consistent appearance, whether it is professional, humorous, or colorful.

d. Unified graphic sizing - In places where the graphics are related to one another, i.e., bullets and buttons, the graphics should be the same size.

ii. Identification of site and pages - Site and page identification should be at the top of every page.

iii. Navigation options - Allow readers to navigate through the Web site without having to stop at every page to look for the navigation elements. Put navigation menus in the same place on every page. If navigation icons are used, be sure that the same icons are used for every page and in the same order.

a. Navigation bar - Unless the site has only one page, the site needs a common method for navigation, either placed at the top or the bottom. If the content exceeds a single screen, the navigation bar should be at the top of the page. If the user must scroll through several screens, it is a good idea to put another navigation bar at the bottom. Pages also need a way to return to the home page. This could be a small icon, or a hyperlink, or a menu bar, at the bottom of the page.

b. Table of contents - Larger Web sites should furnish a table of contents on the home page. Usually located on the left side of the Web page, it provides an overview of the content and links to specific places within the site.

iv. Grid - Break the screen or window into regions and put the same information in the same region. Creating an invisible table is a good way to ensure the use of the grid.

a. Scannability or chunking information - Organize the Web page to maximize the user's ease of finding information. Web pages should be scannable with similar content grouped together in paragraphs or lists.

b. Page length - There are no hard and fast rules for how large or small a Web document must be. One file is easier to maintain, however, large files take a long time to download and require a lot of scrolling. Allow the content to determine the

size and number of pages by following the one-topic-per-page suggestion used by many professional Web designers.

v. Margins - Wider margins tend to add the visual contrast necessary to make reading easier.

vi. Horizontal Layout Control - Create visual variety. A page requires elements of different levels of importance. Mix short thoughts, such as headlines, bullets, and pull quotes, with long thoughts like paragraphs. Keep paragraphs between four to eight lines.

B. Create the home page - The function of a home page is to introduce and guide readers to the features the site has to offer. It is typically an index page. The home page sets the tone and organization for the site and contains links to all its supporting pages.

i. Structure formatting

a. Headings - The first heading should reflect the purpose of the document itself, as the title would in a hard copy document. All headings should be as descriptive as possible because some Web searchers use this information as a means of indexing document content.

b. Paragraph and Line breaks - An important feature of HTML is that word wrap is under the control of the browser. Paragraph breaks separate the text for easy reading by inserting a blank line. HTML ignores consecutive paragraph breaks and automatically adds breaks after special formatting tags like headers and lists. Forced line break tags tell the browser to enter a line feed and to continue the text on the next line. Unlike paragraph breaks, line breaks are single-spaced.

c. Horizontal rules - Use horizontal rules to partition the page but use them sparingly. Too many horizontal rules and dividers can make the page look choppy.

ii. Design Formatting

a. Character formatting - Blinking text and other excessive decorations can be distracting and make the content difficult to read. Think carefully about the colors and textures selected for backgrounds and their effect on the readability of text. In addition, background colors and textures can also affect download time.

b. Making lists - Lists help focus the user's attention on a series of items and make digesting many bits of information easier.

c. Making tables - Tables are ideal for creating nicely formatted columnar output. Tables can contain either text or images.

iii. Inserting Hyperlinks - Hyperlinks should be a descriptive and integral part of the text. Whenever possible put the link on the item itself. Try to make linking words or phrases part of a meaningful sentence, so that the user has a clear understanding of where they are going once they connect to another page. It is important to balance linking within the page design. Too many links can be a visual eyesore on the page and a distraction from the original information. Don't create dead end links.

iv. Using graphics - Graphics should provide useful, visual clues about the information provided. Take into consideration the many different browsers that will be used to display the home page. The design should accommodate the common screen resolution of 640x480 pixels. Add alternate text to every image, even if it is just an empty string, for individuals loading pages over a modem with images turned off or users using non-graphical browsers such as Lynx.

B. Create the supporting pages - Supporting pages contain the substance of the site, e.g., syllabi, class schedules, curriculum vita, articles, etc.

i. Page signature - Place a standard signature at the bottom of all major pages. The signature should contain the name of the page owner, date of last update, organization name, and an e-mail address for comments and reporting broken links.

ii. Navigation - Include a link to the home page at the bottom of each page. Visitors should be able to move from one major page to another within the site without having to go back to the home page. Put cross-links to major pages at the bottom of all pages.

C. Test Web pages - A well-designed Web site should look good on all platforms, i.e., Macintosh, PC and UNIX workstations.

i. Different browsers - Test the pages with several browsers including at least one non-graphical browser to make sure that information is accessible to the broadest possible audience.
ii. Different monitors - If possible check the Web pages with clients from more than one platform to verify the appearance of the information. Testing on smaller monitors is also a good idea.

IV. Implementation
   A. Transfer files and posting pages - Put the Web documents and graphic files on the Web server by using FTP, Fetch, or the Publish feature of the HTML editor.
   B. Promote the Web sites - Advertise the Web site through traditional means, i.e., bulletin board notices, announcement to class, notation on syllabus, as well as on-line methods such as e-mail, newsgroups, web directories, and search engines.

V. Operation and Maintenance
   A. Adding or changing the content - Readers only come back to sites when there is something new to see. In order to keep the Web site interesting, it should be constantly updated by adding new information, rotating articles, and changing graphics.
   B. Check links frequently - Readers can become frustrated when they find several links on a site do not work. It is important to check them periodically.
   C. Ask for feedback - The best way to ensure the Web site meets the needs of its intended audience is to ask for feedback. This can be in a variety of ways. Examples include either asking directly, i.e., question the students during class or posting the request on the home page with the response being sent by e-mail.

Conclusion

With regard to optimal configuration of Web page components and presentation features for an effective Web site, this study found that Web sites that were ranked as exemplary tended to be fun, inviting, captivating, original and innovative. Exemplary Web sites also had a layout that was easy to read, a table of contents, and a visitor counter while poor Web sites did not. Web sites without an identification of the school, class, or author always received a poor ranking. Web page design elements that would reduce a Web site ranking from average to poor included a missing e-mail address, a missing "last updated" date, and a missing list of credits.

A need was identified for a model Web site along with guidelines for conducting in-service workshops on creating effective Web pages. The intent of the model Web site was to inspire instructors to think about the design process before actually creating their Web documents. As more college departments experience the benefits of having an on-line presence, the urgency for in-service workshops will undoubtedly rise. The training guidelines were designed to accommodate this anticipated need.

In summary, an instructor's Web page represents a vehicle for communication. It enables the instructor to relay course related information to his or her students, and, in addition, provides an introduction to the instructor's areas of interest. This format also links the instructor to the academic community detailing research accomplishments and organizational activities.

For these reasons, the analysis of instructor-generated Web pages serves to capture key structural and content components with the intent of improving the effectivity of this format. As the number of Internet-based courses grows (and the growth rate appears to be exponential) the instructor's web page may become the primary link between the student and the instructor, replacing face-to-face contact. All the more reason to analyze and improve the medium. It is hoped that this research provides a baseline for the growth and development of this most necessary communication vehicle.

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Constructivist Theory into Practice: An Interpretivist Research Mural

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Abstract: An age-old work of art has attracted just about everyone to its crowded "theater." This drama of public education has changed in numerous ways over the years, and it is the times of change that have attracted the most crowds. Now is such a time. It is predicted that about a third of the actors (teachers) will be replaced by new ones in the next 10 years, and these new actors will play new roles in addition to the existing ones. The change in their roles is connected to the change in the theater form, which includes the audience's (learners) transformation from a passive to an active, participatory role. The audience participation, in turn, changes the lines of the actors, who must now be prepared for spontaneous and artistic dialogue with the audience. It is also obvious that the set on the educational stage is going through dramatic change. Old props are being torn down to make room for new ones. The computer is the newest of them. In such a change scene, how can the new actors learn new roles and lines from the old schools of teaching? When the curtain goes up, will they be ready? When the curtain comes down, will there be applause?

This research study was an attempt to present ways to teach the new players (preservice teachers) their new roles and lines (constructivist ways of integrating technology in their teaching) that have come out of the recent expectations from reform in instructional practice. The qualitative study uses a constructivist instructional design model (Willis, 1995) R2D2 (Recursive and Reflective Design and Development) and an interpretivist framework (Elliot Eisner's educational connoisseurship and criticism) to design a course on Computers in the Classroom for preservice teachers.

Adequate technology in many classrooms is now somewhat of a reality (Ely, 1996; National Center for Education Statistics (NCES), 1997), but recent reports highlight poor use of the existing technology (Stone, 1998). Despite the evidence of the educational benefits of technology (Garner & Gillingham, 1996; Kulik & Kulik, 1991) teachers are ignoring the potential of the computer (OTA, 1995). Lack of suitable training, technical and administrative support, systemic incentives, traditional pedagogical beliefs, disparate preparation of preservice teachers to use technology, and resistance to change are some of the reasons that are widely held (OTA, 1995; Abdal-Haqq, 1995; Willis & Mehlinger, 1996). Some believe that technology can stimulate educational reform and play a significant role in supporting higher order learning (Means, 1994) while others express deep reservations about technology's potential in the classroom (Tyack & Cuban, 1995; Apple, 1993). Educational reform also calls for a shift in teaching and learning styles, in teaching strategies, and in adopting technology to support learning. Much of proving the true potential of computers in education hinges on the successful roles of teachers in the classroom (Hannafin & Freeman, 1995), and teacher educators face a major challenge in designing entirely new experiences for preservice teachers that can fully communicate the nature of school reform today, and the role of technology in that scene.

This challenge deserves the attention of teacher educators since research shows the value of well-designed courses in leading to good uses of technology in the first year of teaching (Ellis, 1992). Other studies show that preservice teacher education is not designed for successful integration of technology (Becker, 1993a), for adequate preparation of preservice teachers (Davis, 1994; Byrum & Cashman, 1993) and for keeping up with the pace of technology adoption in schools (Becker, 1993b).

The connection between educational reform and technology in teacher education is strengthened by the call to go beyond teaching the use of equipment and software to showing preservice teachers how technology in the classroom can change teaching practices (Sandholtz, Ringstaff & Dwyer, 1996). At the heart of technology and school reform is the requirement that teachers change drastically how and what they teach, and teaching

practices based on educational reform are clustered around cooperative and active learning (Jones & Meyers, 1993, Papert, 1980), conceptual change (Posner et al, 1982), situated and generative learning (Brown, Collins & Duguid, 1989), cognitive flexibility (Spiro et al, 1980) anchored learning (Cognitive and Technology Group at Vanderbilt, 1990), and cognitive apprenticeship (Collins, Brown, and Newman, 1989). National standards and guidelines on technology curriculum also call for preservice teachers to gain knowledge about the impact of technology on schools and society (ISTE, 1992; NCATE, 1993). It is obvious from the focus on constructivist teaching practices and technology integration in preservice teacher education that the technology course, in order to be successful and useful, needs to include an examination of pedagogical practices based on the teacher's epistemological beliefs.

Current practices in teacher education approach technology education through skills-oriented technology courses, pedagogical practices through methods courses, and educational theory through foundations and educational psychology courses. The current technology education curriculum also lacks historical perspectives and social implications of technology. Can a research- and theory-based technology education course integrate multiple perspectives in technology education, pedagogical practices, and learning theories and offer all three to teacher education? This paper is the narration of such a research study to design a course on Computers in the Classroom that is based on interpretivist research, hence the word mural, and social constructivist theory. It includes the interpretivist process of defining, designing, developing, and disseminating the technology course.

Metaphor for the Study

The art of pottery is the metaphor that we use throughout the paper to describe the research process, and the act of throwing a pile of moist, malleable, rich clay (our perceptions, ideas, understanding) on the research "wheel" to fashion a pot of experiences through the course for teachers on technology use is a representation of our work.

The prevalent focus in educational reform on constructivist teaching practices lead us to match our research efforts with a constructivist research base. Besides, our goal to teach about and through worldviews is best served through a constructivist inquiry paradigm. Interpretivism, therefore, served as the research and development wheel. The goal of interpretivist inquiry is "understanding and reconstruction of the constructions that people (including the inquirer) hold..." (Guba & Lincoln, 1994), and our research study included gathering, pooling together, and analyzing multiple perceptions of technology education, pedagogy, and epistemologies of practice. This was followed by an attempt to represent that understanding through designing a course and teaching the course. As Lincoln and Guba assert, this multiple knowledge was accumulated through a hermeneutical and dialectical process. These processes were inherent in the educational connoisseurship framework (Eisner, 1991) and the constructivist instructional design model (Willis, 1995), R2D2 (Recursive and Reflective Design and Development) that we used for the study.

Educational Connoisseurship and Criticism

Eisner's version of constructivism is grounded in the work of Suzanne Langer and Michael Polanyi. This method is an alternative to qualitative approaches stemming from ethnographic traditions in social science, and acknowledges the philosophy of art in the constructive cognitive process. This method is concerned with how the inquirers develop "an enhanced capacity to perceive the qualities that comprise the educational experience and, further, how they can develop the skills to render those perceptions in representational forms that portray, interpret, and appraise educational phenomena" (Schwandt, 1994).

This study challenged us to look at the new and evolving field of technology and teacher education through our own eyes and the eyes of many others involved in that work. And then, through those multiple visions, find a meaningful way to represent and express the insights that we constructed to preservice teachers. It is the entrusting of this process to the philosophy of art and representation that allowed for educational connoisseurship, which Schwandt terms the "art of apperception." It also allowed us to perceive and understand the various subtleties in this field, and to express it in forms that are of use in the classroom. Eisner (1985) argues that the connoisseur does not simply perceive the world with the senses. Rather, the act of perception is "a framework- or schema-dependent cognitive act." Therefore, for those of us involved in the process of this

research, it was the use of a heightened awareness or educated perception to a phenomenon that we were all engaged in, and deeply familiar with, that of technology and teacher education, that allowed for the watchful connoisseur's eye (as metaphor for all the senses) to be in a state of enlightenment.

What is seen through this enlightened "eye" then needs to be represented in an expressive form that "illuminates, interprets, and appraises the qualities that have been expressed" so it can inform and reeducate the perception of the audience. Here, we as inquirers turned from connoisseurs to critics in order to seek ways that successfully transformed our perceptions to expressive forms (Eisner, 1991).

R2D2: The Instructional Design Model

As a design model based on constructivist-interpretivist theory, R2D2 (Willis, 1995) offered a perfect framework to guide this aesthetic and representational process. The study was conducted in three connected nonlinear cycles using R2D2, which was developed during work at NASA's Johnson Space Center in Houston and the Center for Information Technology in Education at the University of Houston. The three cycles of research were define, design and develop, and disseminate.

The define process sought to understand the context of technology and teacher education in a Midwestern University town through a participatory design team of teacher educators, graduate and undergraduate students in curriculum and instructional technology, inservice teachers from the community, and administrators. In the design and develop stage, the design team shaped the course based on this understanding. The course was then taught in Spring 1999 as part of the dissemination stage.

Define: Centering the Curriculum Clay

Those familiar with pottery understand the difficult and necessary task of centering the clay so a beautiful and symmetric shape can be constructed. This is the most important step in giving form to the loose pile of clay. It would be no exaggeration to say that we spent the most time in this research study in finding that center so we could design a course that included multiple perspectives in technology education, beliefs that influence how we teach, and teaching practices based on these beliefs. Because the research process was not linear, we offer the details in specific but connected areas.

Creating and Supporting a Participatory Team

Willis (1998) cautions that this is the most difficult task facing a constructivist designer. While creating a team may be easy, supporting, encouraging, and facilitating participation in one is not. And that was true to our research too. We had a rather large group of teacher educators, graduate students, preservice teachers, inservice teachers, and some administrators, but the core group included two teacher educators, 6 graduate students, and 2 preservice teachers. While difficult graduate courseloads and schedules were problematic, the compatible philosophical bent in the team was the strongest factor. We all believed that teaching as a communicative and artistic process was not about transmitting information, but about the making of meaning. The team's familiarity with the design model and how it worked was another strength.

Progressive Problem Solution

Willis (1998) recommends regarding the work of design as a "process of progressively solving multiple problems in context." This thread runs through our entire work, and was especially relevant with our attempt to adopt a value-based arts approach tied to constructivism. Constructivism is a well documented theory of knowing and coming to know but is not yet a well-documented theory of teaching (Fosnot, 1992). Existing research in the field of education reveals the interest in the potential of social constructivist principles to learning and instruction (Brown, Collins, & Duguid, 1989; Prawat, 1996), but the tie to teaching is largely untapped. According to social constructivist principles, which is the theory base for our research and teaching, learning is an active process of constructing, and this social construction of knowledge depends on the prior knowledge of, and beliefs of the learner, and the social and historical context through which this knowledge was constructed. The design team worked through interviews, informal meetings, and e-mail exchanges to sketch for ourselves, the context of technology and teacher education that we wanted to explore.

Contextual Understanding

Based on our intensive external gathering of information and experiences, and the internal reflection on those ideas and experiences, we had a mass of ideas, and observations from students and practitioners (teacher educators and inservice teachers) about what ought to be included in our curriculum. The team then spent the most effort trying to center those perceptions and knowledge that we had constructed so we could find an artistic and yet utilitarian form for its expression. The first task was really in bringing it all together: we had so many disparate experiences, perceptions, golden nuggets of knowledge and wisdom that it was hard to bring it all together into one mass or whole of technology and teacher education. Many a time, when we thought we had it centered, we really were at the periphery of the wheel, precariously off-center.

We were well aware that our mass of technology and teacher education went beyond the skill-oriented lumps of authoring, simulations, hypertext, Web design, and educational use of the Internet. The final "lump of clay" that we had to work with was about worldviews on teaching, evolving concepts and strategies in teaching with technology, policy and funding issues on technology in education, children's learning styles, teachers' roles as change agents, reform in instructional practice, and the dialectic tension among the many polarized issues in schooling. How does one express these necessary but complex issues in the technology curriculum to preservice teachers in ways that are pedagogically appealing and effective?

Philosophical insights, inspiration, and use of metaphor all worked in harmony to drag us back to the center. Greek, Roman, and more contemporary philosophers and leaders in education have shown us the virtue of employing metaphor to teach, and to help students see and feel. Berger (1991) contends that educational theorists and philosophers like Plato, Comenius, Locke, and Rousseau not only used metaphor, but in explaining the metaphor, revealed to us how it controlled their thinking. Rousseau (cited in Postman, 1995) compares learners to plants and wrote in Emile, "Plants are improved by cultivation and man by education." Lakoff and Johnson (1980), in their book *Metaphors We Live By*, make a strong case for metaphors and how they influence our perception and thought about a situation.

Design and Develop: Curriculum to Instructional Practice

Even though we were not in search of a metaphor and were only seeking a simple way to express our complex collection of ideas, a metaphor presented itself to us: a journey. The educational computing course as a rich, authentic, and complex journey through two different worldviews (behaviorism and constructivism) with numerous stops filled with concepts and strategies, and plenty of time for reflection and understanding in-between. Now we had no doubt that teaching preservice teachers about integrating technology in their teaching went far beyond teaching skills backstage to a very pivotal center-stage role in a teacher education program. This is especially relevant in the context of reform in instructional practice. There is a shift now in the playing out of the reform scene in instructional practice. Entirely new roles and characters have been added and this is obvious in reform efforts and research that promote constructivist teaching methods. The producers of the play wish for the audience (learners) to come to increasingly complex and sophisticated understandings in education, and for that the new players need new lines and teaching strategies. The reality in education is that the existing cast is expected to learn new lines and carry on the art of teaching with these new concepts and tools.

The R2D2 model does not separate design from development, but integrates the two. The leading task here is to choose an environment for development including the tools and process for design. It became apparent a few weeks into the design process that our tools to design the course were "soft" pedagogical tools but they provided the power and flexibility needed to design the course. In fact, they provided the clarity and flexibility within a broad framework so we could look ahead and visualize the unfolding of the course.

The broad pedagogical style or soft tools through which we chose to express this curriculum includes shaping classroom experiences through metaphors, questioning, and definition (Postman, 1995). The basic goal to get our students to understand different worldviews and to examine their teaching based on those worldviews, lends itself well to the field of technology and teacher education, where many new concepts, strategies and details of the worldview are still unfolding. The opportunities to hold up the scene of knowledge-making in the educational scene are numerous. For instance, many of the new educational terms like scaffolding, cognitive apprenticeship, situated learning and authentic learning can be examined for meaning-making through definition, activities, and questioning. Each one is explored in the context of a place to visit and the concept is brought to life through a set of connected metaphors.

Part of the course outline that students get the first day of class includes a "road map" for the semester of the "concepts and strategies" that they'll visit, and compares to a visual representation of the curriculum.

Meaning making through experience lies at the heart of constructing and understanding a worldview, and that will be the focus of the course. A journey, an exploration to understand the culture of a concept and its use, the frequent partaking in a feast to develop a unique taste for computer use in the classroom, a plant, a sponge, a sieve, a funnel, or a filter in terms of being a learner are all metaphors that can appeal to the "collective memory" of students and take them, through leaps, to experiences, on which is based the building of a worldview.

On a particular day in class, students may take the cooperative learning "train," and explore the "town" of anchored learning together. They may "visit" the gas station to pick up the curriculum that fuels their trip and the "City Hall" for the technology education standards and developmental guidelines before they begin to "explore." Using Piaget's developmental stages as a guide, they may assess ISTE's National Educational Technology Standards and how they match the readiness of the child for any specific integrated technology activity. Students may then visit the "hardware store" where they can access a variety of technology tools to actually check their suppositions. They may engage in an activity or two from the " Adventures of Jasper Woodbury" before they check into the "library" for ideas and guidelines on making their anchored instruction activity connect to all the diverse learners in their classroom. The "Information Kiosk" is available for FAQs, and the local "newspaper" for scenarios that they may read in groups to analyze the educational value of the anchored instruction activity. The last stop, of course, is the "courthouse", where they explore the idea of assessment, and judge the quality of the total experience.

How is the concept of anchored instruction used here? Could it be integrated in different ways? How does content area influence the use of this concept in integrating technology in teaching? Do the national standards and their prescriptions match the developmental guidelines that child development specialists have outlined? Is the content culturally biased and fails to reach some students? How did the use of technology alter the learning experience? How does the existing definition of the concept match what has been learned through experience of the concept? As students articulate their ideas to numerous questions like these they can witness how their knowledge is being drawn out through their experiences. Most of these "places" will be visited several times during their "trip" and at first, their learning may seem to come full circle, but in reality, it will be more of a spiral. When they do come back to anchored instruction, their understanding may be a little above, to the side, or below their previous understanding because of the numerous dimensions and additive nature of their learning. They are finally lead to a depth in expertise from where they can themselves function as experts and design their own experiences for their own students in their own classrooms.

Conclusion

The constructivist framework that we used for our research required us to to first seek different perspectives ourselves in technology and teacher education, and then to express it in a way that would address and challenge the learner's thinking. We believe that the R2D2 design model allowed us to explore, understand, and express instructional technology in those very terms. We understand that we ourselves as teacher educators need a fluid, flexible, and diverse set of tools with which to express our understanding of the ecological culture of teaching with technology. In addition to broad principles and worldviews, we can model in aesthetic yet specific ways (or broadly prescriptive ways) so students can construct for themselves both the art and science of teaching, for one cannot exist without the other. In fact, it is at the dialectic tension between the two that the most creative and effective strategies for teaching are discovered. Designed group activities, video cases as artifacts of instruction, thorough examination, questioning and discussion of written scenarios, weighing the amplification-reduction aspects of technology after activities including computers, and examining the use of metaphors will all play a role in our classroom culture.

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Audience Parameterization in Multimedia Authoring Systems

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Abstract: Existing authoring systems usually adopt different approaches to authoring with ranging complexities. Much of the research today has focussed on how would the final multimedia application look leading to little, or even a lack of, concern with authors and the process of authoring itself. This work looks at the problem of authoring from the authors' point of view. The authoring process is analyzed and some guidelines, in the form of a paradigm, are produced describing its main stages and characteristics. A new authoring paradigm, starting with audience parametrization and going all the way to fine grained object instantiation is presented. Central to our approach is the way we look at how the author may adapt objects to its own subject and to its audiences. We hope that through the proposed model, we reduce efforts wasted on what we refer to as "mechanical steps", hence allowing the author to concentrate on more productive project design and thinking.

Introduction

The wide spread use of multimedia tools often involves people from different walks of life including education specialists, designers, publishers, marketing and sales personal and film producers. The integration of various media has proven to be a powerful mean to facilitate communications and persuade users. It is the dynamics of media such as video and audio that makes information absorbing go beyond traditional tools, carrying new human dimensions such as emotions and feelings. As most multimedia users are not computer literates, we look at how easy it is for them to produce multimedia presentations under current multimedia authoring tools by analyzing the stages, components and complexity of the authoring process itself.

The Audience – An Important Parameter

Recent studies conducted by researchers from different institution lead to the use of models where the audience is considered as the main element of the system author-object-user. In his book "*Designing Visual Interfaces*" [Mullet, 1995] presents the difficulties encountered by project designers in defining the intended audience and tries to seek in the theory of communication concepts that may assist designers in gaining better understanding the parameters that should delimit their projects. This proposed technique has been known as the "*communication oriented technique*". Another alternative proposal presented by [Bonsiepe 1997] in his book "Interface, an Approach to Design" follows the same line of thinking, confirming the relevance of the theory of communication as a conceptual basis for multimedia design projects.

The Authoring Model

The proposed model has been tested and evaluated with the participation of graduate students from our visual programming course since 1996. It takes as its basis, the technique described in [Dondis 1991] in order to describe the audience's graphical object repertory.

Main Components of the Authoring Model

It is a distributed multimedia generic authoring model with four main modules namely presentation, authoring, hypermedia and distribution support. The authoring module is the object of detailed study in this paper. It is divided into two main parts: authoring in the large and authoring in the small as shown in figure 1. Authoring in the large is the process that starts the modeling of an application at the most abstract level possible required by the author. This specification is then continuously refined until it results in one that is as close as possible to the application being presented. The advantages for such a separation include the possibility of re-using the conceptual model in the design of other applications where different refinements and extensions could be made in order to adapt this to its new application target. This is similar to the template concept used in software engineering design.

Figure 1 describes a methodology with stages representing the natural and intuitive course of an authoring process, was established. Starting with a generic model, successive refinements are applied until it results into the author's target application. The methodology consists of the four stages:

1. *Conceptual Modeling* - an open authoring stage allows the modeling of real world situations. It defines relations among topics/subjects/themes;

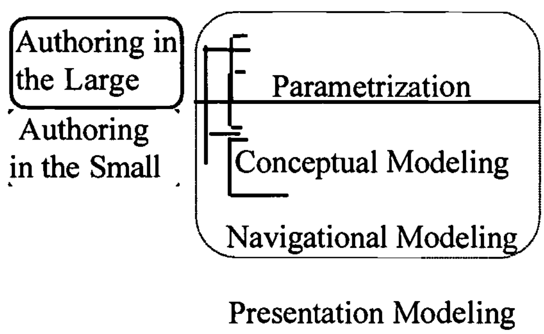

Figure 1 - Overall Development Methodology

Figure 1 – The Authoring Model

2. *Navigational Modeling* - oriented towards the manipulation of the conceptual model previously created; it defines the navigational aspects through the promotion/election of parts of the topics/subjects/themes to the status of nodes; and the promotion/election of some of the relations to the status of links referred to as "application links
3. *Presentation Modeling* - at this stage is defined the presentation interface and user interaction aspects. Different aspects are considered, including static aspects such as application layout, dynamic aspects with synchronization , and the behavior of authoring objects under the effect of external user interface events;
4. *Instantiation* - multimedia data is created and associated to the elements of the presentation according to the pre-established of the author's model as defined in the previous stages.

An Analysis of the Multimedia Authoring Process

So far we have discussed the different paradigms and modeling techniques the proposed solution will have.

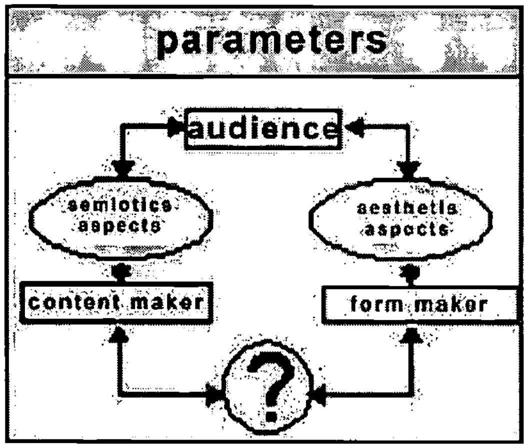

Figure 2 – Parameterization

Next, we describe in chronological order, which concrete authoring stages this solution defines in order to implement the proposed new paradigm.

To implement the four modeling parts, namely, conceptual, navigational, presentation and instantiation, the proposed paradigm defines seven stages that an author may execute sequentially or in a cyclic way. These are:

1. *Audience parameterization*: defines parameters controlling the application. Examples of these are: the levels of users (beginners, advanced, etc.), the application purpose (education, entertainment, sales, etc.), users age, presentation language, etc. The idea is that for each set of parameters, the same application using the same underlying model presents a different scenario. Note that this parameterization is represented by the concept of contexts earlier defined in the model. This phase results in the definition of user profiles where a profile is seen as a set of parameters that describe users' interests, levels, etc. Furthermore, objects retrieved from distributed databases and stores may be adapted according to audience parameters. We have identified two main information aspects for defining parameters as shown in figure 2:

- *Semiotic Registering*: during this phase of the project, media objects are selected (text, images, sounds, video clips, etc.) which make part of the audience repertoire. Usually these objects are subject to adaptation and changes prior to their use;
- *Differential Semantic*: this phase of the project is based on the visual characteristics of the visual messages, proposed by [Dondis, 1991] in order to build a polarity system enabling the graphical analysis of common presentation forms in an audience as shown in figure 3;

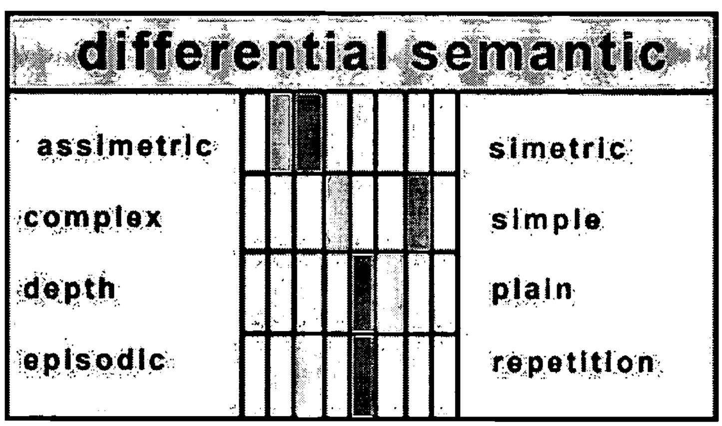

Figure 3 – Differential Semantic

2. *The global database*: our information database may be seen as global as the Internet information web. Examples of research efforts that considered the use of network resources to improve and facilitate the authoring process are found in [Siegel, 1996] and [Waters, 1996]. Information objects, local stores as well

as Internet sites may also have parameters or information profiles, associated to them to accelerate information retrieval during the authoring process by matching these to user profiles and search parameters;

3. *Generating Alternatives*: based on the information obtained so far, the model uses the morphological box technique presented in [Bomfim, 1995] for generating alternative solutions to the project;
4. *Analysis of the Alternatives*: this is the final phase of the proposed model and deals with the selection the audience's most expected solution for the projected multimedia information. Weighted criteria are used to evaluate the alternatives
5. *Definitions of blocks, sub-blocks and relations*: Here the application is structured in terms of blocks of information and the relations between the blocks are established.
6. *Definition of a media library*: The user may now gather all the objects he will possibly use. These will be kept in a library and this library may be saved and reused.

Working per block.

7. The author may now select one block and start working with it.
8. *Defining the graphics information of a block.*
9. *Definition of the flow and object synchronization of a block*: using this option the author may define temporal relationships among the objects of a block, through the use of a flow line to which a time scale has been incorporated, in order for these relations to be as much visible as possible.
10. Test: the author may, during the authoring process test or run the entire application, or use selective testing of blocks. The author may repeat any of the steps above at any time to introduce new changes.

Conclusions and Future Work

The way presentation parameterization has been offered by the authoring system in this paper is certainly very helpful for the authors. The resulting presentation produced under the hints given by the system is more likely to approach its audience under most cases. However, there is still a long way to go. The ideal support given by the system would be an automatic generation of, at least, a draft of the presentation, that could be modified by the author. Furthermore, an ideal authoring system should also support the production of different versions of the same presentation for different kinds (levels) of users, keeping its structure and changing the object instances accordingly. Perhaps the major problems with this approach are not implementation issues but the conception of the idea of versions itself. The presence of a wide spectrum of users may sometimes need so many changes to be made to the original application that it becomes, not a new version, but rather a completely different one. Furthermore, some applications target a given specific user community that it does not make sense to create a version for another user group (For example we do not see many financial presentations being distributed to children!).

Because of the increasing Internet popularity as a global information source, we are currently investigating the development of a high level search tools capable to look for elements (images, videos, animations, sounds, texts - not only home pages) on the Web under the input of a high level query (Ex: images and sounds related to animals). The implementation uses smart agents; a widely used technology [Garzotto, Paolini, Schwable 91a].

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A Grounded Theory of Instructional Design

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Abstract: This paper presents a grounded theory of instructional design as an assimilation-based process in response to calls for instructional reform as institutional innovation. Two hypotheses are presented and a matrix of instructional reform and innovation is illustrated. This matrix indicates that the central tensions driving the integration of technology into the postsecondary environment are between institutional standardization v customization and between instructional reform through the design of instructional experience at the classroom level v the design of instructional materials at the discipline level.

Introduction

Information age models of learning often seek to reform educational practice by providing convenient and accessible on-line delivery of a broad range of instructional materials; interactivity intended to prompt active learning and independent problem-solving; and rich and authentic resources to foster discovery and exploration. While the use of technology for instruction is not a new proposition, integrating and support the *new* digital technologies into postsecondary academic environments is hampered by problems of scalability and technical support. Wagner (1994) suggests that it is necessary for institutions to "break away from models that feature the technologies themselves, and instead must focus on the results they hope to achieve through effective technology use" (p. 17). In their article on the crisis in information technology support, McClure, Smith and Sitko (1997) argue that the transition occurring within higher education requires "organizations to focus on institutional processes, such as learning or managing a department. We will have to accomplish this by partnering with faculty or administrators--those with the content and functional expertise" (p. 21). Stahlke (1996) has argued that attempts to reform higher education must:

> Start with, and pay serious attention to, those categories and enterprises that define the college and university. For reengineering to so succeed, for innovation to occur, it must start from teaching and learning, and a second parameter -- appropriateness -- must be added to scalability. (p. 46)

In addition, the move to integrate information technology into the postsecondary environment has placed greater emphasis on faculty development efforts to improve teaching practices through the use of technology (Smith, 1997).

Ultimately the decisions to design and use technology-based materials at the classroom level remain the decision of individual faculty. This is particularly the case at postsecondary institutions serving the educational needs of four-year undergraduate residential students. This study examined the conditions and processes that organize the design of technology-supported instruction by faculty participating in an institutional innovation effort. This understanding can provide useful information for managing the institutional change occurring as traditional roles and responsibilities of media production and delivery units shift. It can also help to define staff training needs, hiring needs, and partnership needs. Finally, a more informed understanding of how faculty use technology can contribute to research on the pedagogical effectiveness of using media and technology in support of instructional goals. In this way, the proposed study will provide an important foundation for the development of strategic planning activities that impact the adoption and support of information technologies for postsecondary teaching and instruction. This theory of faculty approaches to instructional design can be used by information technology and instructional design staff to inform faculty development initiatives and to guide institutional efforts to reform postsecondary instruction.

The Study

A grounded theory methodology focuses on change and indeterminacy. Two distinguishing features of grounded theory methodology are that it is interpretive work and that its emphasis is on the development of substantive theory (Strauss and Corbin, 1994). This approach is appropriate for this study given the variable and dynamic context that characterizes postsecondary teaching and learning environments. In this grounded theory study I examined three related phenomena:

1. The principle concerns and activities that organize faculty approaches to the design of technology-based instructional materials for classroom use,
2. The ways faculty adapt perceived advantages of technology to serve their instructional needs within specific discipline-based content areas,
3. The institutional mechanisms that structure faculty efforts to design and deliver technology-based instruction as institutional innovation effort.

In order to examine these phenomena my research design needed to account for personal interpretations and social and institutional relationships. To do this, I selected three conceptual frameworks to guide my data collection and analysis. Symbolic interactionism was used to examine communication and interaction processes among faculty, students, and administrators as aspects of teaching behavior. Constructivist principles of learning was used to examine how faculty address discipline-based content learning needs and teaching methods they used to create new learning environments. Cognitive anthropology was used to examine the norms, values, and standards that shape innovation institutional.

The Research Setting

The research site for the study was a four-year residential, state-assisted, Research I university with a total student enrollment of approximately 18,417. In this report of my research, I refer to the university as Central State University (CSU).[1] In early 1995, CSU's Chief Information Officer and its Vice-Provost for Academic Programs collaborated to secure funding for faculty development of instructional applications of information technology. This initiative reflected their increasing awareness of expectations from both within and beyond the university that faculty could use technologies such as email and the Web to support instruction. The result of this collaboration was the Innovative Technologies (I.T.) program. The I.T. program had two broad goals: 1) to help faculty overcome barriers to the adoption of technology for instruction, and 2) to assist CSU faculty in developing innovative teaching practices.

The day to day implementation and management of the I.T. program was to function as collaboration between the CSU's Teaching Support Unit and two staff hired as I.T. Technology Advisors. Faculty applied for I.T. grants in the early spring and a panel of peers and I.T. staff selected projects. Approximately twelve faculty per year were selected to be I.T. Fellows and awarded individually tailored packages of resources such as release time, stipends, graduate student staff budgets, and hardware and software budgets. Upon selection, I.T. Fellows were expected to manage their own projects with assistance from I.T. advisors who were available for project assistance and consultation. The teaching support staff hosted monthly meetings for I.T. Fellows to present works-in-progress or to discuss relevant issues such as copyright. The Teaching Support Unit also began each project year with a retreat and concluded each year with a "de-briefing" session in which I.T. Fellows were encouraged to discuss their total project experience. I.T. Fellows were also required to submit final reports that documented their project experience.

Selection of participants

The sample of research participants consisted of 40 individuals. This sample included 33 faculty fellows who have participated in the I.T. program over the three project years ('95-'96, '96-'97, and '97-'98). These faculty

[1] I use pseudonyms throughout this study for individuals, programs, offices and institutions. I asked research participants to contribute their time, examples of their work, and to open their classrooms to scrutiny. In return, I offered to be an attentive listener and to contribute toward his or her own goals in a professional manner in whatever way possible. In addition, I agreed to protect their anonymity and confidentiality.

fellows came from disciplinary departments across CSU. As a group, they included the natural sciences (4); arts and sciences (15); engineering and applied sciences (4); professional trades (6); and the social sciences (4). In addition, their faculty ranks included assistant, associate, and full professorships. I.T. project staff, administrators, and a selection of other university leaders critical to technology infusion were also included in this selective sample. I included this last group of individuals to sample CSU's history of using technology for instruction. These individuals held present or former roles as committee chairs, administrative directors, and executive administrators responsible for technology integration.

Data Collection and Analysis

The primary method of data collection was in-depth interviews and classroom observations. These primary data collected were supplemented - and triangulated - with data from a number of additional sources. These included: notes from I.T. monthly meeting, project proposals, final reports, publications authored by I.T. Fellows that report on their I.T. year as well as publicly available articles (e.g. newspaper, trade publications) about I.T. Fellows' projects, course syllabi, and instructional materials such as electronic and digital media that fellows developed while participating in the I.T. program.

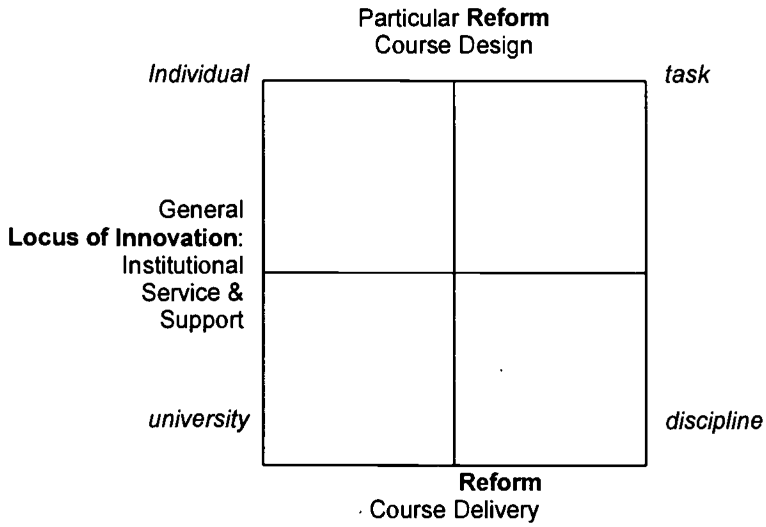
The qualitative analysis computer program "FolioViews" (Miles, 1994) was used to manage data coding and analysis. As I collected data, I began initial coding on each interview transcription or on data recorded in field notes following classroom observations. I coded data to facilitate sorting the data into categories. As Charmaz (1983) notes, "codes range from simple, concrete, and topical categories to more general, abstract conceptual categories" (p.111). Glaser and Strauss (1967) note that upon saturation, the researcher collapses codes into categories and continues with the identification of category properties. A final stage of coding begins with the process of integrating concepts and categories into a whole. I wrote analytic memos to examine the integration and opposition of categories. These narrative documents serve to relate categories to other categories, tighten logical relationships, explore implicit assumptions, and uncover relationships and definitions within the data that may not have been apparent as categories or codes. In this final coding stage, I identified a core phenomenon that accounted for the predominate patterns in events and process relating to the research phenomena. As suggested by Glaser (1992), I selected the core phenomena on the basis of its ability to account for the greatest variation in patterns. It was the core phenomena that I considered to be the most basic social process (Glaser, 1978). I integrated categories in relation to the basic social process of assimilation using the following grounded theory coding paradigm recommended by Strauss and Corbin (1990) and Cresswell (1998): Causal conditions that gave rise to a phenomena; Context, which define specific conditions where actions and interactions occur; Intervening Conditions which are broader conditions that facilitate or constrain actions and interactions, Strategies, which describe the way specific phenomena are managed, and Consequences, which are the outcomes of the strategies

Findings

As the core phenomenon, an assimilation-based process of instructional design is characterized by faculty approaches to organizing learning as a transformation, by the adaptation of technology to teaching methods that have a high probability for success because they reflect discipline-based inquiry processes, and by using entrepreneurial skills to compete for institutional resources. Figure 1 provides a graphic representation of the components of the model. As a consequences of using an assimilation-based process of instructional design strategies included: the development of learning systems characterized by loose collections of resources; the development of specific courseware applications authored by individual faculty much as textbooks have been traditionally authored; "Performance environments" student publication on the World Wide Web resources; "Doing X" - for example, doing history - that provided verification of transformation that resulted from using technology-supported instruction as a first step toward academic assimilation; legitimizing job-training skills as a by-product of teaching with technology. At an institutional level, consequences included value-added benefits of technology-supported instruction were normalized via repeated course scheduling, endorsements from executive administration, rapid prototyping of technologies, and by creating links of dependency among and between university service units and academic departments.

As a result of this theory I formulated two-hypothesis. The first is that an assimilation-based process of technology-supported instruction is a rational response to a lack of formal training in learning and instructional theory. The second is that information-age models of learning derive from interactions between institutional technology support and the instructor's approach to design as an experience-based process or as a materials-based

process. I illustrate this using a matrix of competing tensions along two continuums (see Figure 1). One continuum highlights reform activities ranging from the reform of course design to the reform of course delivery. A second continuum highlights the locus of innovation established through technology support and services at the institutional level to innovative instruction situated at the classroom level. These two continuums form a matrix useful for classifying the assimilation -based processes and conditions that organize faculty approached to the design of technology -supported instruction.



I. information technology as proscenium,
II. information technology as heuristic,
III. information technology as instrument,
IV. information technology as conveyance

Figure 2: Reform and Innovation Matrix

When using *technology as proscenium*, I.T. Fellows designed projects that functioned as *particular* reforms using *general* methods of resource support and allocation for innovation that allowed for customization. These particular reforms focused on developing repositories of content based on visual information, or in which visual information has primacy over text information, as in this project description offered by Prof. Boyd:

> In context we try different interactive things. Here is a map of some of the key installations of this national project and they can click on this and get quite a bit of detail, more detail, than I would give them in lectures, for that matter more detail than I would want them to read in just text. They can understand what the science community was actually doing with pictures and one of the nice things about this is that they can click on this and they will get the this organization's homepage and realize that this thing was started for military purposes.

They are particular because the are intended to reflect the I.T. Fellow's expert interpretation and point-of-view. Consequently, general support in the form of assistance by CSU's technical staff is customized according to the individual goals of I.T. Fellows. This experience-based approach required technical support staff who are personally committed to the project, either because of the technology used or because of their own knowledge of the content.

Fellows designing projects that fall within the *technology as heuristic* quadrant, like those located in the technology *as proscenium* quadrant, rely on institutional support that permits customization. However, whereas fellows using *technology as proscenium* address particular reform based on an their interpretation of content, fellows using *technology as heuristic* address particular reforms based on classroom tasks. These include using new communication strategies, problem-based collaborations, or project-oriented tasks in which students are asked to synthesize concepts and principles to construct original representations of content. For example, Prof. King has adopted two new teaching strategies used to inform both his teaching as well as student understanding. The first is

the use of a web-based anonymous feedback form that allows students to address immediate points of confusion regarding the course material as well as to express more affective frustrations. The second is the posting of student homework. Prof. King scans in samples of student solutions to homework problems, annotates them, and selects an example of an excellent solution, an adequate solution, and a weak solution. He then posts these on the class web site (examples are posted anonymously) along with commentary describing the strengths and weaknesses of each answer. I.T. Fellows independently manage, design, and develop these projects and directly customize the technical infrastructure to meet their classroom needs. For example, they may set up server accounts for their students and request ftp or cgi scripting processes.

When using *technology as instrument*, I.T. Fellows designed projects that function as *general* reforms using *particular* methods of resource allocation for innovation. General reforms use technology tools to address instructional needs at a discipline level. These reforms derive from instructional materials that exists in "old" media formats - such as a textbook - that are re-purposed to take advantage of new media attributes not available using the old media format, e.g. animation and 3-D modeling. Using the web, Prof. Carter has been able to put the entire set of relevant chemical reactions into an interactive format. This has allowed him to present a range of some 150+ chemical reactions. Previously, he could only offer a few examples from the textbook he and a colleague have authored, in spite of the generous number of color photographs that it contains.

> The student simply picks out the reaction and the program calculates the relationship on the fly for that particular chemical. It uses equations hidden from the student. The student doesn't need the equation, they want to see the result in this case and analyze the reactions... so the convenience is you can cover all of the chemicals and their reactions.

Particular methods of resource allocation are supported by CSU's technical delivery infrastructure, and I.T. Fellows select software standards or standardized hardware configurations that they know will be in place to deliver their technology resources. This materials-based approach requires a that a set of standardized resources be available from which I.T. Fellows can select those needed to meet their general instructional reform goals. In the above example, Prof. Carter personally wrote Java code and his applets required the use of a browser plug-in that he had installed on computers in a lab that he expects his students to use. Thus he relied on the standard access to a browser in CSU's labs, and then added a particular technical configuration required fir the use of his resources.

Fellows who design I.T. projects that fall within the *technology as conveyance* quadrant also address general reforms. However, unlike I.T. Fellows who use *technology as instrument* by selecting a particular technology on the basis of its attributes and then standardizing delivery, *technology as conveyance* projects use technologies of delivery solely to deliver content. These are often faculty with minimal or beginning level technical skills interested in learning to use development tools such as presentation, digital imaging or authoring software. Their instructional reforms focus primarily on presenting information in a technology format to large classes of students with diverse goals such as might be enrolled in an introductory level survey course. Their projects usually begin with the development of a web-based syllabus and posted reading lists and lecture notes. CSU's technical staff often design templates or a standardized interface to increase the I.T. Fellow's ability to efficiently use hardware and software. Staff does not consider the technical needs of these I.T. Fellows as difficult and therefore, they primarily guide graduate or undergraduate students to provide support and to work more closely with the I.T. Fellows.

When developing general innovations using general resources, these projects have one of two goals: (1) to highlight linkages and connections within a broad content area or (2) to reframe the curriculum by making certain types of connections salient, e.g. connections across time or geography. In working toward these goals, I.T. Fellows seek to redirect student attention away from a habituated approach to learning in which they seek only the most obvious understanding of the content toward a more original, attentive, and perceptive insight into the content. By presenting content in an alternative manner, I.T. Fellows hope to maximize its novel effect. They also seek to heighten motivation with the use of graphics, dynamic movement, and real-time access to recourses. In addition, I.T. Fellows aim to personalize the content by integrating examples from their own collections of videos, artifacts, music, interviews, newspaper and television clips, and the I.T. Fellow's own published scholarship.

Conclusion

One conclusion that I have drawn from my interpretation of the data in this study is that building an information technology infrastructure to support and sustain new models of learning hinges on the constant negotiation of tensions between institutional technical support that is standardized, but flexible enough to address

classroom processes, and tensions between designing new instructional experiences versus new instructional materials. While information technologies may be used to restructure and organize new models of learning, the manner in which faculty design instruction that relies on technology is highly assimilative. As previously suggested, this approach may be quite rationale given the lack of formal training for most postsecondary faculty. The greatest level of customization at the classroom and at the content levels occurs when faculty can independently manage the technical aspect of their project, or when they are able to enlist technical support staff with a vested interest in the content. At an institutional level, the sum is a Brownian-like motion of instructional design strategies that reform models of learning.

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DIFFERENT APPROACHES OF SYSTEM ANALYSIS IN MULTIMEDIA COURSEWARE DESIGN

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Abstract: Multimedia courseware design is a process of system development. In this process, system analysis is one of the most important components. This paper will present a study in which three system analysis approaches were examined regarding to their influences on students' multimedia application design with *Hyperstudio*. Three system analysis methods—free style method, outline method, and structured modeling method—were used in three groups of students. A concept-mapping package *Inspiration* was used in structured modeling group. The response measurements were the layers of the links, the interactions the links performed, and the link-interfaces the students designed for their applications. Mixed-model ANOVA was employed for data analysis. Differences were found among the three groups.

Introduction

When we do a *PowerPoint* presentation, with the mouse click or the automatic time setting, the slides will appear on the screen in the order we designed them. For example, slide 2 will be after slide 1, and slide 3 will be after slide 2… The slides are connected by linear links. However, when we use a multimedia authoring program, such as *ToolBook* or *HyperStudio*, to design a multimedia application, the *pages, cards, or different media* are connected by linear or non-linear links. Which page or which card will appear on the screen depends on which link we choose among all the links. All the contents in a multimedia application interact, via all the links, in an environment that is defined as a multimedia information system (Beasley, 1998-99). Therefore, the process of designing a multimedia application can be considered a process of information system development. In the system development life cycle, system analysis is a major phase in which task/content analysis is performed and the structure of the system is defined in detail.

There are many methods that have been widely used for systems analysis. This study examined whether the structured modeling method was different from free style method or outline method in performing systems analysis for a multimedia courseware design.

Review of Background

System Development Life Cycle (SDLC)

When we develop a database for employee/student management, when we design an online registration/purchase form, or when we design an interface that perform the control of certain device, we are developing systems. The system development has its life cycle. Traditional system development life cycle is divided into seven phases (Yourdon, 1988; Burch, 1992):

1. Systems planning
2. Systems analysis
3. General (or conceptual)systems design
4. Systems evaluation and selection
5. Detailed (or functional) system design
6. Systems implementation
7. Systems maintenance

This SDLC is applied in commercial and industrial fields. System development starts from systems planning phase, and goes through first six phases to its implementation. After the new system is developed and converted to

operation, it goes into the last phase--systems maintenance phase that may last several years. When it becomes no longer efficient or effective, a new system need to be developed to take the old one's place. The SDLC starts all over again.

For the purpose of developing interactive multimedia instructional applications for classroom teaching/learning, Beasley (1998-99) modified the traditional SDLC into four major phases:

1. Systems analysis
2. Systems design
3. Systems implementation
4. Systems maintenance

Generally, in the systems analysis phase, the system developers determine *What To Do*. In the systems design phase, they determine *How To Do*. In the systems implementation phase, they *Do It* and implement the system. In the last phase, they maintain the system until the next life cycle. The current study mainly concerned the phase of determining *What To Do*.

In both the traditional and modified SDLC, systems analysis is identified as a major phase. In this phase, first, the major problems are identified (Grabowski & Droms, 1994; Henderson, Gold & Tindall, 1996; McDeniel & Liu, 1996). For example, a teacher wants to improve his/her students' ESL (English as second language) achievement in reading and writing. Second, the scope of the system is determined (Burch, 1992; Stier, 1994; Beasley, 1998-99). For example, among the available technology equipment and software, multimedia application may be an option of the solution. Third, task/concept analysis is performed (Fankhauser & Lopaczuk, 1996; Vrasidas & Harris, 1995; Beasley, 1998-99) to determine what contents to be included and what tasks each content will fulfill. In the same example, the multimedia application may include texts, sounds, graphics, and videos to enhance reading, listening, speaking and writing in ESL learning. Fourth, learner analysis is performed to gather information on the learners in an attempt to more fully understand who they are and what instructional needs they have (Fankhauser & Lopaczuk, 1996; Vrasidas & Harris, 1995; Beasley, 1998-99). The literature also suggests some other detailed analysis such as objective analysis, constraint analysis, and costs/benefits analysis (Fankhauser & Lopaczuk, 1996; Vrasidas & Harris, 1995; Beasley, 1998-99; Fox, 1995; Mauldin, 1996).

Next, in the system design phase, output layouts are designed for all screens, special forms, and printed reports; all inputs are specified and formats, both screen and paper forms, are also approved. Based on the output and input designs, specific processes are designed to convert the inputs to outputs. Databases and controls also are designed in this phase (Burton, 1992; Henderson, Gold & Tindall, 1996). According these designs, detailed tasks of the system are implemented, the system is developed and converted to operation (Burton, 1992). Then the system is maintained until next life cycle.

Reviewing the system development life cycle provides an understanding of the position of systems analysis in the process of system development. The current study focused mainly on systems analysis, especially, on the methods of performing task/content analysis.

Structured Modeling in Systems Analysis

In systems analysis, the structured approach is a disciplined, engineered approach that employs discrete phases as defined by the SDLC. The goal of the structured approach is to develop an information system that meets the original objectives and requirements, and is easy to work with, understand, and maintain (Burton, 1992; Vrasidas & Harris, 1995; Henderson, Gold & Tindall, 1996). Structured modeling is to provide, verbally or graphically, an overview structure or a model of the entire system. Structured modeling in task analysis is implemented with modeling tools.

Modeling tools are used to model and describe various systems, subsystems, and software design on paper or screen for review and evaluation by system developers and users (Burton, 1992). Modeling tools break a system down into manageable parts and provide all viewers a visual structure of the system's conceptual and functional characteristics. In the structured modeling process, modeling tools divide a system again and again into several independently operable modules until each module contains one well-defined function. A model that is selected for implementation is a complete and coherent representation of what the new system will be like and how it will work.

Some modeling tools that have fairly wide acceptance are: Data Flow Diagram (DFD), Data Dictionary, Entity Relationship Diagram (ERG), State Transition Diagram (STG), Structure Chart, Structured Program Flowchart, Process Specification Tools, etc (Burton, 1992). All these tools work practically the same way, and the significance of using these tools stands for their potential to provide diagrams or charts that visually represent the system (The samples of the modeling tools will be presented at SITE). The current study applied Structure Chart in designing a HyperStudio application.

Structured Modeling in Multimedia Application Development

Multimedia in the field of education is defined as computer controlled interaction among several media such as texts, graphics, sounds, videos, etc. (Reed, Ayersman, & Liu, 1995; Stier, 1994). Research has shown that the capabilities of multimedia learning environments to store, interconnect, and provide access to a wide range of knowledge represented with all the media provide significant affordances to enrich student learning (Bagui, 1998). A multimedia learning environment can be viewed as a multimedia system, and its system analysis can be implemented with the modeling tools to deal with the complex interactive relationships among all the media—when, what, and how to link them together.

The questions are: when using the modeling tool, for example, structure chart, how should we develop a model that best fits the purposes and requirements of the system? What is the appropriate way to structure the chart? A literature suggests that it is easier and more effective to use graphical tools or concept mapping tools to organize knowledge and create diagrams to navigate through instructional hypermedia program (Chavero, Carrasco, Rossell, & Joes, 1998; Chou & Liu, 1998). Also, Paivio (1986) proposes a dual-coding hypothesis that if information is resented in both visual and verbal formats, stronger learning should result. In system analysis, the verbal format may be an outline analysis, and the visual format may be a structured diagram analysis. Does Paivio's (1986) hypothesis support the information representation in the system analysis? Does verbal analysis present a model as effective as diagram analysis does? Or are the relationships (links) of a multimedia application produced from verbal analysis more interactive than from diagram analysis? Few studies have addressed the above questions.

Purposes and Research Questions

Specifically, the purpose of this study was to investigate the effectiveness of three methods of system analysis in designing the links of a multimedia application. The three methods of system analysis were: (a) free style method, (b) outline method, and (c) structured modeling method.

The following research questions were examined in this study:

1. Is there any difference between the link designs of a multimedia application produced from *free style* system analysis method and with *structured modeling* system analysis method?
2. Is there any difference between the link designs of a multimedia application produced from *outline* method and with *structured modeling* method?
3. Is there any difference between the link designs of a multimedia application produced from *free style* method and with *outline* method?

It was hypothesized that the differences would exist.

Methods

Subjects

The subjects of this study were 45 teacher education students enrolled in a basic computer technology course in an eastern state university. The subjects' ages ranged from 18 to 42 (the average age was 22.36), including 11 males and 34 females. Around 90% of them had no previous computer skills, beyond using a word processor.

Procedures

The task of this study was to develop a multimedia application on certain teaching topic they chose. The software used for this task was *HyperStudio*, a multimedia program with which a set of Cards can be created and linked linearly or non-linearly. Each card can contain text, graphics, and sounds. The buttons in each card performs the links.

The students were randomly assigned into three groups. Before the students worked on their *HyperStudio* cards, they were required to do the system analysis, that is, to make a plan to determine how many cards they were going to create, what would be in each card, and how these cards would be linked together. Three system analysis methods were employed: (1) Free style method. This was not a particular analysis method. The students started to work on the first card, and thought about what would be in the next card. After they created several cards, they decided the way to link

them. (2) Outline method. This was a verbal presentation of their application. They wrote an outline about what would be in each card and how the cards would be linked. (3) Structured modeling method. This was the diagram method. They created a diagram, or structure chart to present a visual structure of their application. A concept mapping tool *Inspiration* was used to draw the diagram or chart. Each group applied one method to plan their application.

The system analysis method was the independent variable for this study, with three levels indicated by the three methods described above. The links they created in their *Hyperstudio* stack were compared.

Measurements of Link-Designs

The link-design scores were the sum of three link-measurements. (1) Linear links. This was the lowest level of links--the cards are linearly connected, from one card to the next card, from first card to the last card in one direction. Linear links would be scored 10 points. (2) Layers of links. This was the medium level of links—the cards are connected in several layers. Each layer would be scored 4 points. (3) Interactions. This was the highest level of links. Two kinds of interactions were measured: (a) interactions among cards in one layer scored 5 points; (b) interactions among cards across two layers scored another 5 points, and across three layers for another more 5 points . . .

The link scores of the three measurements for each subject were added together as the response measurements for this study. (The samples of outline method, diagram method, and the layer measurements will be presented at SITE)

Research Method

This study employed an experimental method. This was not a completely random design, the subjects were an existing group of students. However, they were randomly assigned to the three groups. Therefore, it was assumed that all other conditions were under control and different system analysis methods would result in the differences of the link designs.

Data Analysis

According to the design of this study, one-way mixed model ANOVA was the appropriate method for data analysis. A SAS macro MIXANOVA (Fernandez, 1997) was used to perform the data analysis and assumption checking. The plots obtained from this macro showed that the assumptions of normality, equal variance, and extreme influential outliers were not violated. The significant level for these analyses was set at $\alpha = 0.05$.

Results

First, the results of descriptive analysis showed that the mean of free style group (group A) was 9.93, the mean of outline method group (group B) was 22.36, and the mean of structured modeling method group (group C) was 36.70.

Second, the results of analysis of variance are shown as in Table 1.

Dependent Variable: RESP Response

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Treatment	2	2948.40000000	1474.20000000	55.34	0.0001
Error	42	1118.80000000	26.63809524		
Corrected Total	44	4067.20000000			

Table 1. Results of Analysis of Variance

As shown in the results, significant differences among the three groups were found ($F_{2,42} = 55.34$, $p < 0.0001$), indicating that the treatments—the three system analysis methods—did make difference in the response variable, the link designs.

Third, a comparison analysis was performed to determine where the differences were. The results are shown in Table 2.

contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
a vs b	1	607.50000000	607.50000000	22.81	0.0001
b vs c	1	874.80000000	874.80000000	32.84	0.0001
a vs c	1	2940.30000000	2940.30000000	110.38	0.0001

Table 2. The Results of Comparison Analysis

The results in Table 2 show that all the three F ratios are significant, indicating that (1) significant differences were found between free style group and outline group ($F_{1,28} = 22.81$, $p < 0.0001$); (2) significant differences were found between outline group and diagram group ($F_{1,28} = 32.84$, $p < 0.0001$); (3) significant differences were found between free style group and Structured modeling/diagram group ($F_{1,28} = 110.38$, $p < 0.0001$).

The comparison plots obtained from the analysis also show that (1) the measurement mean score of the diagram group is higher than that of free style group and that of the outline group; (2) the measurement mean score of the outline group is higher than that of free style group.

Conclusions and Discussions

In conclusion, the results of the data analysis answered the three research questions. The research hypothese was tested to be true for this set of data. The findings of this study suggest that using structured modeling tool in the system analysis of a multimedia application development will produce more interactive links with more layers than using outline method or free style method.

When using *Inspiration* to perform system analysis, students may benefit from the visual effect of the structured chart or relationship diagram. The chart or diagram can provide the structure of existing relationships, based on which students can add more links. Although, *Inspiration* has the function to switch between diagram view and outline view, the structure (the concept map in *Inspiration*) is created first in a diagram view, then it can be switched to outline view. If the structure is started from an outline, the situation will be different. An outline is a verbal information presentation. When working on an outline structure, students need to first mentally convert it into a graphical structure, which requires certain cognitive abilities. Some may not be able to perform this cognitive process; they may stay with the verbal format that will not stimulate their imaginations of complex relationships.

Another suggestion derived from the current study is that the use of *Inspiration* is not limited to concept mapping. *Inspiration* is also an efficient tool for system analysis and for multimedia application development. Further studies may be conducted, with a larger sample size, to investigate the differences among linear links, layers of links, and the interactions of links.

The findings from this study provide evidence that it is necessary to integrate the knowledge of system analysis into the multimedia design or instructional design courses for teacher education students. Also, system design can be applied to numerous applications—such as database design, courseware design, and Web application design. It is believed that there are many potential problems in this field that need to be explored.

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Flexibly Delivered Environmental Education 'Down-Under': A new approach to an on-campus pre-service teacher education unit

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Abstract: Higher education institutions are rapidly moving from a bi-polar model of face-to-face/distance education to what is being termed *flexible delivery*. Flexible delivery refocuses educational activity to meet the needs of individuals in a diverse and rapidly changing social context (Rigmor and Rosemary, 1995). However, the flexible delivery emphasis to date is largely upon off-campus/external students. This paper reports upon an internal/on-campus flexible delivery pre-service teacher education (Environmental Education) unit and the response of internal/day campus students to this initiative.

Introduction

"The Australian higher education system is in the process of dramatic and far reaching changes to teaching and learning arrangements that will alter the ways in which university staff and students engage in education at this level" (Rigmor and Rosemary, 1995, p. 1). In fact, Australian federal governments have equated technology with cost saving and thus universities have been encouraged to embrace flexible delivery for on-campus and off-campus study (NBEET 1994; Taylor *et al.* 1996; NBEET 1997; Forster *et al.* 1997) to the point where in 1997, 13.3% of total university enrolments were external (DEETYA 1998; McKay & Clarke, 1998).

Thus the significant change to this construction of teaching and learning is in the mode of delivery, which is now rapidly moving from a two-pronged model of internal/external to a blurring of the boundaries known as 'flexible delivery'. Flexible delivery is an approach to providing educational opportunities that are focused on the varying learning needs and circumstances of students (Taylor, 1995). These include arrangements such as those which allow for varying the venues and timing of delivery, content (including assessment), the use of resources and technology in the primary delivery phase, and the valuing of student background and previous study.

While these technologies have been developed for distance education, they have enormous, and as yet under-utilized, potential to enhance on-campus teaching. Taylor (1995) refers to the 'tyranny of proximity' which has proved a disincentive to educators teaching on-campus students to experiment with innovative teaching strategies as alternatives to traditional face-to-face teaching practices. The cost-effectiveness of these 'mixed mode approaches' has been demonstrated (Taylor & White 1991; Taylor *et al.* 1993).

Therefore, this paper will report upon the first flexibly delivered internal/on-campus unit to be offered at the USQ. It will describe the development of the pre-service teacher education unit Environmental Education (80218) into flexible delivery mode.

Flexible delivery ... What is it?

Flexible delivery allows for more pedagogically appropriate approaches to be fostered than was previously possible. It caters for a wider variety of students' learning styles in addition to removing the tyranny of distance from the educational needs of students. However, the term 'flexible delivery' has been used and misused by many institutions to mean anything from distance education to email and web-based delivery to a myriad of other computer-based resources (McKay & Clarke, 1998).

In this study, the definition of flexible delivery adopted as proposed by Taylor *et al.* (1996) that "... *'flexible' is used to refer to practices which utilise the capacities for learner-learner and teacher-learner interactions made possible through recent developments in communication and information technology to provide increased 'openness' in both on- and off-campus delivery of educational programs. .... we use the expression 'flexible modes of delivery' to capture [a]... combination of philosophy and technology, [recognising]... that this combination frees the provision of educational programs from both geographical and time constraints."*

Flexible delivery is essentially concerned with designing learning opportunities that are economically sustainable and pedagogically defensible in the current social climate. It is concerned with promoting deep approaches to learning by purposefully selecting forms of delivery which:

* are multi-dimensional
* increase the choices available to staff and students in teaching and learning
* result in a blurring of the traditional internal/external boundaries

Flexible delivery brings together three dimensions:

* *student learning*
* *forms of delivery*
* *content*

Flexible delivery is concerned with shifting practices in two ways (Rigmor and Rosemary, 1995). Firstly, recognising the use already made of resources in both external and internal delivery, it seeks to maximise the use of these resources and, in fact, replace some face-to-face teaching with resource-based learning opportunities. In this situation, the role of the teacher moves from being the primary resource to one of many resources, and from the centre of the delivery to the facilitator. The implications for information literacy are significant. With information now being available from a wide variety of sources, students must understand how to interrogate these resources to learn from them.

Secondly, it seeks to reconstruct the educational practices of universities in terms of student learning rather than teaching. The task of the teacher is to manage the education process by facilitating and structuring access to resources and by providing opportunities for interaction. In order to achieve this, options formerly associated with either internal or external delivery may be invoked.

Technology is a central aspect of the shift in both these practices: the non-human resources themselves are technology based (for example, print, video, multimedia), and the means (for example, computer networks, videoconferencing links and postal services) of accessing or locating these resources or the human resources involved are also often technology dependent (Rigmor and Rosemary, 1995; Nunan, 1996).

Flexible Delivery at the USQ

The University of Southern Queensland (USQ) is a medium-sized university with a strong background in distance education delivery and international provision. USQ sees its size and background as major strategic advantages in securing its future as a major flexible university. The University sees a flexible approach to education as an essential element of its teaching and a key to its future development as a competitive international higher education provider. Networked information technologies have been exploited in a service known as USQConnect to offer comprehensive educational, administrative and support services to its students located around the globe.

The shift in focus at the USQ from traditional delivery modes/approaches to flexible delivery is not only in response to an ever increasingly competitive domestic and international educational market but also to utilise worldwide technological developments that at present has resulted in a proliferation of computer-based courses. In 1998, this culminated in the trial implementation of course materials into flexible delivery mode.

The Flexible Delivery initiative aims to provide better teaching and learning opportunities at a time and place convenient to students and staff through a variety of techniques and media. Flexible Delivery at USQ incorporates not only traditional face-to-face and print based delivery but also uses a variety of electronic technologies to enhance student and teacher access to people and other learning resources.

Apart from the more traditional technologies such as print, broadcast television and radio, the following new technologies provide opportunities for enhancing the quality of teaching: audiotapes, videotapes, computer-based learning packages, interactive video, interactive multimedia (IMM), audio-teleconferencing, audiographic communication systems, videoconferencing, and video on demand (VOD) (Taylor, 1995). In recent times these technologies have been supplemented by the advent of the opportunities for interactivity and access to instructional resources provided by the computer communications networks popularly referred to as the "Internet", the "World Wide Web" (WWW) or the "Information Super Highway". As Swannell (1997) highlighted recently, flexible learning systems are based on a *"philosophy of giving people **what** they want, **where** they want it, **when** they want it (WWW happens to be almost incidental)...."* (p.17).

The emerging fourth generation of distance education, the Flexible Learning Model, promises to combine the benefits of high quality interactive multimedia (IMM), with access to an increasingly extensive range of teaching-learning resources and enhanced interactivity through computer mediated communication (CMC) offered by connection to the Internet (Taylor, 1995; McKay & Clarke, 1998).

Flexibly Delivered Environmental Education at the USQ

In 1998, the pre-service teacher education unit, Environmental Education, was redeveloped into flexible delivery mode. The course has a diverse clientele involving a combination of graduate entry and undergraduate primary and early childhood students. In total, 246 internal students were enrolled in the unit at both the main Toowoomba campus and the regional Wide Bay campus, southeast Queensland.

This flexible delivery initiative resulted in significant changes in the pedagogical approach used - from the more traditional mode of delivery involving face-to-face lectures and tutorials to far more innovative uses of resources including computer mediated quizzes, video and audio-taped lectures, Web-based course notes and unit materials, assignment details and Internet sites plus synchronous tutorials, electronic discussion groups and asynchronous communication via e-mail.

A survey was conducted to gauge student attitudes to the flexible delivery initiative prior to and on completion of the unit (Table 1).

Survey Question:	Pre-test %	Post-test %	Changes %
I feel reasonably confident in my ability to access materials via computer (Y/N):	74.6	82.5	+7.9
I feel reasonably confident in my ability to access the internet (Y/N):	64.9	72.2	+7.3
The layout of the 80218 Home Page enabled me to easily access unit resources (Y/N):	-	86.9	-
How environmentally aware do you think you were (a) before and (b) after the unit? (NB: *Score out of 10)	(a) 5.6*	(b) 7.6*	+35.7
Sample Size (n)	177	129	

Table 1: Pre-test and post-test survey results of student attitudes about the flexibly delivered Environmental Education (80218) unit.

Overall, there was a 7-8% increase in confidence in using the computer resources over the course of the unit. Students commented on the ease of access to the computerized resources and user-friendly nature of the 80218 Home Page (86.9% approval (Table 1)) that readily allowed students to find whatever resources they needed. The resounding increase in student awareness in the unit (+35.7%) may be a function of the flexibility of the learning resources available in the unit.

Additional qualitative feedback indicates that initially, mature age students tended to be less willing to embrace this technological shift compared to the younger students but overall, the changes have been welcomed. An additional outcome was the surprisingly large proportion of on-campus students (~70%) that were able to regularly access the computerized unit materials at their own time and place from off-campus.

Finally, feedback from the Wide Bay campus students on the synchronous video/audio link where NetMeeting/MeetingTools employing a video camera and Smart Board-to-Smart Board hardware via an ISDN link between two PC's was used for tutorial sessions, has been very positive.

Conclusion

The very concept of 'Learning' - how we learn - using the concept of 'plurality intellect' - is forcing us to provide channels for learning different from traditional classrooms. This vital development coupled with shifts and changes in our learning audiences makes it compulsory to search and research new ways to accommodate the human learning potential.

Further, flexible delivery has the interactivity to engender efficacious learning outcomes in a time efficient manner. The immediate access to current materials and associated professional discussion with colleagues from around the world creates a socio-cognitive learning environment from which all who participate will surely benefit. Indeed, the professional networking that is likely to emanate from such approaches to flexible delivery seems likely to engender genuine lifelong learning.

In conclusion, despite the initial demands encountered when developing 'test-case' flexible delivery units, the opportunities offered to tertiary educators are enormous both pedagogically and as a powerful promotional and marketing tool. The flexibility in the educational provision therefore provides the basis for individualised learning-unbound by the tyranny of time and location. As such, flexible delivery represents an exciting initiative for future development of on-campus initiatives in tertiary institutions.

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Design Your Own Instructional Software: It's Easy.

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Abstract: Computer Assisted Instruction (CAI) is, quite simply, an instance in which instructional content activities are delivered via a computer. Many commercially-available software programs, although excellent programs, may not be acceptable for each individual teachers classroom.

One way to insure that software is not only acceptable but also targets a teacher's class in a specific way, is for instructors to design their own software. The HyperCard authoring system is a computer program that enables teachers or instructors, even teachers with minimal programming ability, to easily design their own hypermedia software programs for use in individualized situations. Teachers now have an easy method to teach, drill, remediate, or even test individual classes or students by designing software that targets these classes or individuals.

Introduction

HyperCard is an authoring system which makes it possible for nonprofessional programmers to create original working software applications. It is well suited for building customized personal information managers, educational tutorials, multimedia presentations, and user interfaces to other, less-friendly programs.

Setting Up to Design or Create Your Own Software Program

HyperCard has several "levels" that you can utilize in creating software. Since we will be authoring software and also writing our own scripts, we should select the highest or *scripting* level. To select this level:

- Double click on the HyperCard icon to open it.
- You will then see the Home Card. Click on the arrow in the bottom left of the card and you will see the levels-choice card. Click on level 5 and when it highlights, you will have set your HyperCard to the scripting level.
- Now, click on the arrow to the bottom right of the card and you will return to the Home Card. You only have to set this level once.

You are now ready to begin setting up you HyperCard.

- While in the Home Card, select *New Stack* from the FILE menu. In the resulting dialog box, type in a descriptive name for your stack under *New Stack Name.*
- Click on *Desktop* then double click on your data disk. This is where the stack will be saved automatically.
- Click on *New* and you will then see the first blank page or card of your new stack.
- You are now ready to begin designing your stack or software program.

Designing Your Own Software

Once you have completed the set-up for your stack, as described above, and your first blank card appears, a good idea is to place your tools palette in a convenient place on your screen. To do this, select *Tools* from the menu bar, drag through the palette, and place it in a convenient place. The tools palette, as shown in Figure 1, contains all the normal paint tools and also a browse tool, button tool, and a field tool.

Figure 1: Tool Palette indicating the paint tools and the Browse, Button, and Field tools.

You can use the tools to add text to your cards, draw on the cards, add Art Bits to the cards, erase mistakes, add a pattern to your graphics, etc.

You may decide to design a background for your stack. To do this, select *Background* from the EDIT menu, design your background, then reselect *Background* to return to your card layer. The background you design will appear on every page/card of you stack unless you decide to change it later. You can add a border around the edge of each card, put your name on each cards, add a graphic to each card. Remember, what you put in the background will appear on each and every card in your stack.

Add Buttons to Your Stack

One of the most necessary aspects of your stack/program is to have a method by which students and "navigate" throughout the stack/program. To do this you must add buttons to each card/page. On these buttons you tell the program to go to the card you indicate.

To add a button to a card, click on the *Button Tool* on your tool palette then select *New button* from the OBJECTS menu. A "new button" icon will appear in the middle of you card and will have dashed edges. You can click on this icon and move it any where on the card.

Double click on the "new button" icon and you will see the dialog box as shown in Figure 2:

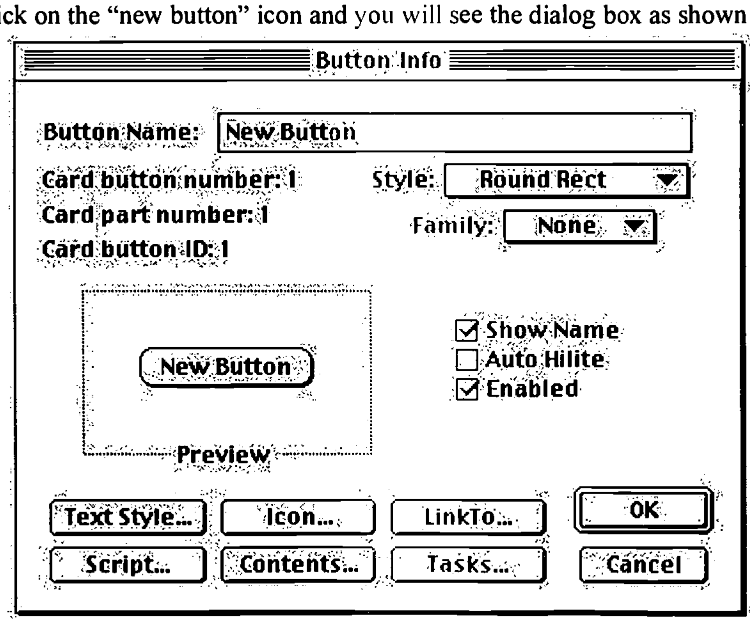

Figure 2: Button Dialog Box for Customizing and Linking Buttons.

As can be assumed from the above dialog box, you can give your button a name, choose a text style, select from numerous icons which turn your button from a round rectangle into a descriptive graphic, can select from a whole line of effects that will occur when the student clicks on the button, and most importantly, can link this card to any other card in the stack or to another stack.

Once you decide on a button style, click on OK and the newly designed button will appear on the card. You can resize it by clicking on the button, click on a corner, then drag it to any size you wish.

Notice that one of the choices from the dialog box is Script. HyperCard will automatically add the script to the buttons as you design and link your buttons but you do have the ability to add to that script to have the button play sounds, add 1 to a correct or incorrect field so the program will tell the student how many correct or incorrect answers s/he has clicked on in questions in the program, slow down or speed up the effects, etc., etc., etc.

Adding Fields to Your Stack

When you click on the "A" tool on your tool palette you will be typing in *bit-mapped text* onto your card. It is much easier to create a field and type into the field because this will add *word-processed text*. Word-processed text is much easier to work with and edit than drawn-in or bit-mapped text.

To add a field to your card, first select the *Field* tool from your tool palette and next select *New Field* from the Objects choice on the menu bar. A new field will appear in the middle of your card, also with a dashed-line outline as with a button. You can change the size of the field by the same method you changed the size of a button, by grasping a corner of the field and resizing by dragging.

Double click on the new field and a dialog box, similar to a button dialog box will appear as show in figure 3.

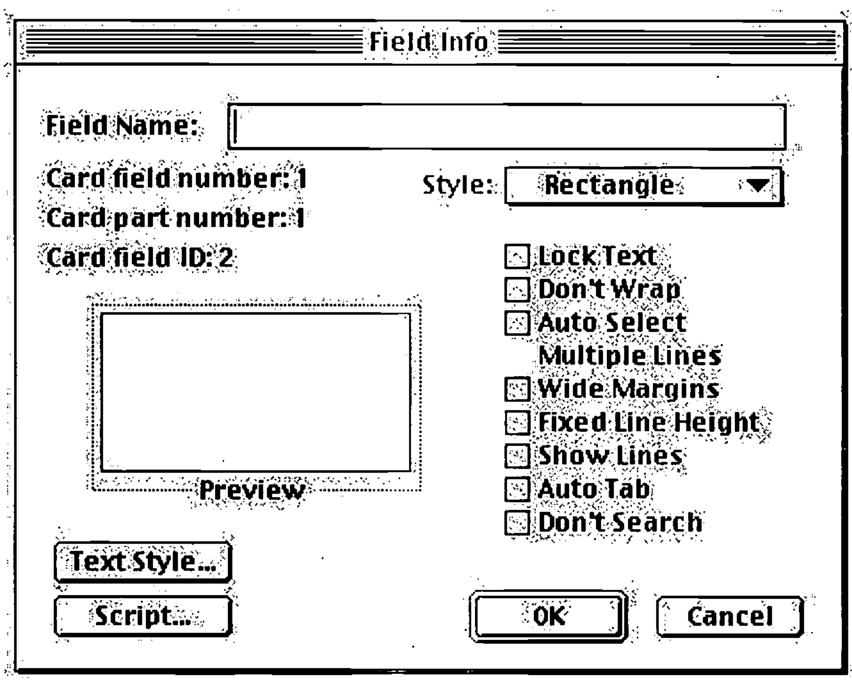

Figure 3: Field Dialog Box for Customizing Fields.

As can be seen, you can change the Text Style, Field Style, name the field, as you did with the buttons.

To type in the field, select the Browse tool from the tool palette, click in the field, and when a blinking cursor appears you can type in the field as with a word processor. You can always change the size of the field if you find you need more room to type in the information.

Adding Graphics to Your Program

Contained in you HyperCard program are a series of graphics that can be incorporated into you stack. You may have noticed this stack called Art Bits on your Home Card.

Procedure:

- Select *Home* from the GO menu; you will see the Home Card containing several special stacks.
- Click once on the Art Bits icon and an Art Bits icon menu will appear.
- Click once on the category you prefer (Beasts, Nature and Science, Transportation, etc.) and you will see the graphics for that category displayed on one or more screens.
- Determine which graphic you want than click on either the Capture tool or the Lasso tool and "capture" the graphic.
- Select *Copy* from the EDIT menu and the graphic will be placed on your clipboard.
- Select *Open Stack* from the FILE menu, locate your stack from the dialog box, then click on open or double click on the name of your stack.
- Find the card/page where you want to place the graphic and select *Paste Picture* from the FILE menu. The graphic will be copied to your page/card.
- Because the graphic will be placed on your card/page in "capture" mode, you can click on the graphic and drag it to where you want to place it on the page/card.
- You can also place graphics from another graphics package into your stack in a similar fashion.

Scripting in HyperCard

Your HyperCard program can be enhanced by scripting, that is writing sets of instructions, called scripts, to customize HyperCard's actions. Everything that happens in HyperCard is directed by a script. HyperCard scripts are written in HyperTalk language, which is very much like the language people use in daily life. Although HyperCard automatically scripts when you select tasks from the button or field dialog boxes, you can add much more power to your program when you add your own scripts. Following are several scripting sequences that you can add to your program.

Some basic assumptions for the following scripting examples:

- Card field "corr" indicates total correct answers.
- Card field "incorr" indicates total incorrect answers.
- Card field "percent" indicates percentage of correct answers.
- Card field "first" indicates a student's first name.
- Card field "both" indicates a student's first and last name.

To Ask the Name of A Student

You can have HyperCard ask the name of a student and display his/her name throughout the program. On the card where you want to ask for a name, select *Card information* from the OBJECTS menu. Click on the *Script* button in the dialog box and type in the following script:

```
on openCard
   global name
   ask "Please type in your first and last name."
   put it into name
   put first word of name into card field "first"
end openCard
```

To put the student's first name on the card where you first ask his name, select *New Field* from the OBJECTS menu and in the dialog box name the field "first" (without the quotation marks)

To Put First Name on Any Card

On any card where you want to put the student's first name, again select *Card information* from the OBJECTS menu, click on script, and type in the following script:

```
on openCard
   Global name
   put first word of name into card field "first"
end openCard
```

As before, you must have a field on that card named "first" (without the quotation marks.

To Put the First and Second Name on Any Card

```
on openCard
   global name
   put name into card field "both"
end openCard
```

Again, you must have a field on that card named "both" (without the quotation marks"

Summary Card

You may have questions as part your program and would like to have students print out a summary card indicating how many they answered correctly and incorrectly and the percentage correct. To do this, you may design a summary card similar to Figure 4.

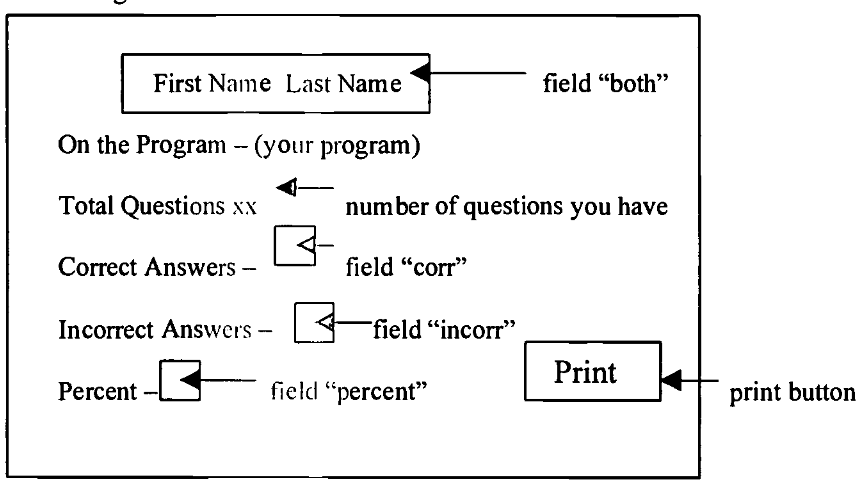

Figure 4 : Sample Summary Card

To add the numbers to the field corr and incorr, you must place the following scripts on each answer button you have in the program:

```
on mouseUp
   Add 1 to card field "corr" of card id xxxx (the card id of your summary card)
end mouseUp

on mouseUp
   Add 1 to card field "incorr" of card id xxxx  (the card id of your summary card"
end mouseUp
```

You'll also need to script the summary card so the percentage of correct answers can be calculated and placed in the field "percent". Use the following script on the card:

```
on openCard
   set numberFormat to "00."
    put card field "corr"/10*100 & "%" into card field "percent"
end openCard
```

As you can see, the number correct located in the field corr will be divided by the number of questions in your program (in this case 10), be multiplied by 100 and this number and the % sign will be placed into the field percent.

The Print button can be scripted easily:

```
on mouseUp
   doMenu Print Hypercard
end mouseUp
```

Other Scripting Possibilities

There are *many* other scripting features available to enhance your HyperCard stacks:

- An "answer" script where you can pose a question in the script, label the responses you want, and the program will automatically show a dialog box for the student where s/he clicks on an appropriate response. This is good for a 'do you want to go on' type of questions.
- A "wait" script where you indicate the time variable before some event happens in the program. Good or showing a field or a card for a length of time then hiding the field or linking to another card.
- A "mouseEnter" command where as soon as the mouse enters a field a specified event will occur. Good for giving 'hints' on questions.
- You can also script and use the if-then-else parameters, and others.

The scripting possibilities are almost limitless . . . but they take a little more time and, in some cases, more scripting expertise than is normally required.

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Weaving the Web: Combining Best Classroom Practices with Technology

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Abstract: This paper will describe a course in which teachers were helped to not only develop effective instructional Web pages but also to integrate them with existing Web sites and classroom instructional activities. A model was used to assist teachers with the development of what came to be called Integrated Curriculum Units (ICUs). A well-planned ICU combines a teacher's special teaching abilities and activities with the Internet without deprecating the value of either. Components of an ICU will be discussed, as well as strategies used to assist teachers in the ICU development process.

Introduction

With schools pushing the use of technology in the classroom, teachers often feel pressured into using Internet resources. One obstruction to integrating the Internet into instruction is that many educators lack the skills necessary to operate and use this global network (Gallo & Horton, 1994). Even when educators are trained on the mechanics of accessing the Internet (primarily the World Wide Web), effectively synthesizing Web sites into instruction can be an arduous task. While the Web offers an abundance of educational sites designed to help teachers integrate Internet resources into instruction, the sheer amount of information available on these sites can be an overwhelming experience to even the most adept user.

Teachers often report a perceived desire from school districts to blend utilization of the Internet into all facets of instruction. This often causes a conflict between their need to use the Internet and their use of previously developed activities. In the case of pre-service teachers, it may even conflict with activities they are learning about in their methods classes. These teachers (both pre- and in-service) need support and encouragement to use the Internet as an adjunct, to combine the best traditional classroom practices with technology to create motivating and effective instruction.

The ICU Process

One possible method for assisting educators with the process of blending traditional classroom practices with instructional Web sites is the development of an Integrated Curriculum Unit (ICU). An ICU is a lesson plan that combines Web resources with a teacher's unique teaching abilities and activities without deprecating the value of either. Using a Web-authoring tool, teachers build an interactive Web page that details components of their unit. Creating an ICU encourages teachers to examine and evaluate whether or not the Web should augment or replace instructional activities.

In an attempt to aid teachers in the ICU process, a course, *Internet for Educators* was developed at a large urban university. The course had four primary objectives: 1) Provide educators training on the use of various Internet tools; 2) Examine various ways in which the Web could be integrated into classroom instruction; 3) Train teachers in the use of a Web page development program (Netscape Composer), and most importantly; 4) Combine the above three skills to develop an ICU to be used in an educational setting.

Preparing an ICU requires much planning and thought. To facilitate this process, teachers created a written proposal that described the unit's topic, objectives, method(s) for providing instruction, follow-up

and enrichment activities, and assessment devices. The instructor advised teachers to view their ICU proposal as a document that could be revised at any time.

The first step in developing an ICU proposal required the selection of a topic. Because the creation of ICUs and the construction of Web pages were new skills, teachers were asked to keep topics simple and manageable. A sample ICU proposal focusing on the Civil War might be scaled back to a specific cause, event, or historical figure. After selecting a topic and providing a brief rationale, teachers were asked to list specific instructional objectives. The instructor reminded teachers to keep objectives to a minimum.

The main difficulties (and also the greatest excitement) in the process came when teachers grappled with instructional issues. How was instruction to be provided? Would instruction be more effective by utilizing existing Web sites? Would creating a new Web page enhance instruction? Would other innovative strategies that did not use the Web be more effective? While teachers were excited about integrating existing Web resources into their units, the instructor encouraged them not to abandon quality non-Internet instructional strategies. Several teachers combined the Web with other classroom instructional activities. At the same time, the amount of information available on Web sites often overwhelmed them. Repeated demonstrations of how large Web sites could be broken down into smaller chunks enabled teachers to choose portions of Web sites that were useful in teaching ICU objectives. Surprisingly, several teachers wanted to use the Web as a tool for instruction but were not satisfied with the content of pre-existing Web sites. These teachers undertook the task of developing their own instructional Web pages.

After teachers conceptualized how they would provide instruction, the ICU proposal required them to ponder methods for providing reinforcement and enrichment. Teachers often felt obligated (due to being enrolled in a technology course) to use the Web as the sole source of these activities. For example, one preschool teacher taught her students the "chicken dance" when studying farm animals. While searching the Web, this teacher found a site that demonstrated movements and sounds associated with the dance. The teacher was reluctant to ignore this site for fear that it would lower her grade. Although the site was well designed and informative, learning the dance as a group provided students with an opportunity to indirectly improve social skills. Frequent reminders by the instructor that off-computer tasks (such as the chicken dance, journaling, art projects, etc.) provided students with valuable and memorable experiences gave teachers confidence in making appropriate selections.

The evaluation component of an ICU required students to think about how they would assess student performance. Because the development of an ICU was such a new process, most students opted for traditional modes of assessment, such as tests, written papers, or projects. Several expressed interest in expanding their Web development skills in order to place quizzes and interactive assessment activities right on the Web.

Conclusion

At the conclusion of the course, ICU projects were permanently uploaded to the university server. As ICU units are being implemented, teachers have been asked to e-mail their reaction as well as their students' to using an ICU in the classroom. Revisions to ICUs are encouraged and require a phone call to the instructor to gain access to the Web server. A few teachers have transferred their ICU projects from the university server to their school district's server in order to freely revise or change their ICU as needed.

Using technology effectively in teaching is a skill that develops over time. As the instructor of this course, the ICU process has proven to be an exploratory process for me as well. Several students accomplished far more than expected. Working through the ICU process with students has shown that certain components require further refinement and clarification. The ICU process has demonstrated that with encouragement and structure teachers can weave in the Web and combine best classroom practices with technology.

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Projects described in this paper can be accessed at http://www.digit.soe.vcu.edu/savitt/home/students.htm

The Goals and Development of an Interactive Web Module For a Teacher Education Course

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Abstract: The World Wide Web has become a promising medium for delivery of instruction. This paper describes a case study in which the Internet was used to supplement teacher education course instruction via an Interactive Web module. The goals of using such a medium for facilitating teaching and enhancing learning are described as they relate to learning theory. Such goals include improving informal assessment opportunities, increasing student evaluation opportunities, and increasing students' opportunity for inquiry based and project based unit plan construction. The Interactive Web Module has been implemented for two years in a teacher education course and has been modified based upon student surveys. This paper also describes the survey results and modifications that were made to the Web module accordingly. Preliminary research on the use of this interactive Web module is described as well as plans for future research. The Web site is located at

Introduction

A new model of utilizing the Internet for learning involves interactive techniques where there is active participation and interaction between faculty and students, students with other students, and students with electronic books, journals, and multimedia resources (Moore, 1991). The goal is not to use the Internet as a static tool, but instead to use the Internet to enhance interactivity and learning. The goals of enhancing learning through the use of an interactive Web module on the Internet, within a pre-service teacher education course, might facilitate the use of technology among future teachers. In the *Report to the President on the Use of Technology,* it was found that there continues to be a need for increasing the use of technology among teachers and their students within K-12 schools (1997). If the use of technology is to improve within K-12 schools then teachers must receive adequate technology training during their pre-service teacher education coursework to provide exposure to and improve attitudes toward the use of technology. Attitude-behavior theory suggests that beliefs about an object lead to an attitude toward it and that attitudes are an important precursor of behavior (Fishbone, Azjen, & Belieef, 1975). Consequently, there has been a good deal of research investigating the way computer-related attitudes and beliefs affect the use of computers by students and adults (Chen, 1986; Rosen, Sears, & Weil, 1987).

The goals of integrating technology through an interactive Web module within this EDUC 539 pre-service teacher education course, as outlined by this case study, are to demonstrate to pre-service teacher education students how interactive technology can support the learning process in a course other than technology. Over the course of two years, an attempt has been made to enhance learning of teacher education students via the use of interactive technology, specifically an interactive Web module, and also to solidly model the use of interactive technology in a teaching environment. It was thought that by providing the opportunity for pre-service teacher education students to use technology as an integral part of their own learning process, their attitudes would improve regarding technology.

Consequently, these students would be more likely to use interactive technology as future teachers to support their students' learning in all content areas.

Learning Goals of Interactive Web Module Development

The World Wide Web is ideal for teachers who wish to use interactive technology to enhance learning within their courses. Since the Web is a newer medium that requires its own presentation style, careful planning is required to building effective Web pages that use learning theory as their guide. The learning goals of the development of the interactive Web module for this case study are described below along with the learning theory that supports these goals.

Improved Classroom Discourse and Higher Levels of Reasoning

EDUC 539 students have access to the lecture notes on-line and are therefore able to write down and engage in the deeper level of analysis that occurs through classroom discourse as opposed to only processing the main ideas. According to Vygotsky (1986) the use of social dialogue and interaction is an essential part of the learning process. Additionally, analytical and synthesis levels of the cognitive domain comprise essential components to the overall development of higher order thinking skills, yet teachers rarely engage students beyond the knowledge level (Elliott, Kratochwill, Littlefield, Travers, 1996). When provided the opportunity to download a hard copy of the main ideas to be discussed in class, teachers can save in-class time to model the concepts, have students apply the concepts, as well as engage the students in deeper level and higher order processing.

Primary critical thinking questions are developed for each lesson and posted at the beginning of the semester so students can review all of these questions at their own pace. Additional critical thinking and applied questions are occasionally devised directly after a class meeting either through the use of a distribution list or the University's chat room so that the instructor can gauge the questioning around student discourse from the prior class session. In doing so, the instructor can reinforce student learning and all students in the course can review their classmates' responses and applications of concepts as a way of evaluating their own understanding. Students can utilize the critical thinking and applied questions as a pre and post-reading tool and as a study guide for their formal assessments. Signaling techniques are advanced organizers that provide a framework for the reader and give cues as to the contents and major themes of the reading passage. They emphasize a passages' organization and conceptual structure (Mayer, 1984) and have been found to increase comprehension (Loman & Mayer, 1983). By providing downloadable lecture notes and critical thinking questions, students who may have processing, auditory or visual motor deficits will benefit as they can view and process the lecture notes outside of the natural classroom time constraints. Teachers can utilize the critical thinking question section by assigning specific questions to students ahead of time; this is particularly useful for students with a processing deficit. All students may benefit by the symbols and pictorial representations as well as the graphic organizers, which are a part of the slide show lecture notes. It would be difficult for students to duplicate these elements of the lecture notes during in class time.

Informal Assessment and Scaffolding

On-line Assignments

The instructor of the course can also create downloadable files which generate tasks that have been broken into short term goals leading to long term course objectives. Students can peruse the scaffolding assignments at any time rather than wait for the hard copy to be distributed in class. When the hard copy of each assignment is then presented to the students, the instructor has balanced the pace of the whole class with the needs of the individual student or group. The downloadable files which support long range goals represents a form of scaffolding by which the course instructor simplifies the task so the student can manage certain components to the overall goal. The instructor also presents cognitive modeling where prompts or cues in the form of the assignments can help the student progress to the next step (Good & Brophy, 1995).

Web Based Testing

Web Based Testing takes Computer Aided Assessment one step further by using Web servers to deliver tests and store student responses in a database. Tests can be multiple choice, fill in the blanks, true or false, or short

answers. The CGI template used to create the multiple choice test is available from . Instructors can tailor their questions to reflect the type of objectives they are covering in their course. Students in EDUC 539 were given a solid framework as a review for their mid-term exam, and were also able to monitor their own understanding of concepts by comparing their responses to the correct answers. This Web based testing represents a cognitive behavior modification technique designed to help students develop goal setting behavior, planning, and self-monitoring (Good & Brophy, 1995), and provides the opportunity for students to master the concepts (Bloom, 1981). The questions on the Web served as benchmarks for students and for the instructor in that students were able to respond to each question after the concept was covered in class to determine their level of understanding. If students responded inaccurately, they would go back to their text, e-mail their instructor, or ask in class for clarification of the concept.

Student Evaluation and Improved Quality of Assignments

Models of former students' exemplary work can also be placed on the Web site as downloadable files or in html format. This serves to support the quality of students' work and represents another component to scaffolding where the instructor has presented an idealized version of the course assignment as a guideline for students to follow (Good & Brophy, 1995). The cognitive modeling occurs while students are exploring each phase of the former students' projects and comparing their product to those they are examining. Students are given a number of projects to view in-depth so that they are able to analyze the intricacies involved in the project assessment such as how multiple perspectives were explored, what critical thinking looks like in writing, how to tailor a product to its intended audience, etc. This leads students to the evaluation level of the cognitive domain objectives in that students are able to compare their work to external criteria (Bloom, 1981). Authentic teacher based products can also be linked to the Web page so that university pre-service teacher education students can recognize, comprehend, and construct products that integrate theory with real practice. This supports students' ability to accomplish the application, analysis, and synthesis levels of the cognitive domain objectives in that these objectives require multiple perspective taking and compiling seemingly disparate components into a new problem solving context (Bloom, 1981).

Inquiry Based and Project Based Assessments

Web Conferencing

Within the classroom, Web Conferences can be used to create small group discussions organized either by topic areas or student groups. Multiple, concurrent discussion groups can be setup and anyone using a Web browser can participate in these conferences. Participants can post, reply, send e-mail messages, attach files, and host real-time chat discussions. The course instructor can moderate discussions and provide direction to the topic being discussed or answer questions posted to conferences by students. The course instructor can also include professionals in the field within the Web Conferences, and can therefore create a community of learners beyond the physical boundaries of the classroom.

Preliminary Analysis

Data has been collected through student e-mail transcripts and chat room discussions, observations of in-class interaction, interviews, and student surveys. The results of this empirical data analysis follow.

Benefits to Instructor

As a result of Web based testing, opportunities for Web conferencing, and critical thinking questions posed through e-mail, the course instructor was better informed about what students were understanding, as well as about the concepts which still needed clarification. The instructor maintained an ongoing historical document of dialogue with students, kept records of common questions asked, and presented questions and responses to all students at the beginning of the class lecture. This provided a perfect summary and/or review by the teacher as it recognized the cognitive misconceptions held by the students and enabled the students to move beyond basic levels of understanding. Students were also able to determine their own level of concept recognition and comprehension and they were able to self-regulate and adjust their understanding when needed. The use of chat room facilitated group

discussions as well as discussions among educational practitioners. The chat room brings more structure to the E-mail environment and builds in *configuration control* in that students are able to build off of one another's ideas and see where they have been and how they got to the line of current thinking and product development. Overall, the interactive Web module enabled the instructor to: 1) monitor concept recognition of the class as a whole; 2) post questions immediately following class associated with what has been discussed in that class; 3) monitor where to begin the next class by adding layers of questioning starting with what the instructor knows the students' knowledge base to be; 4) reflect on the ongoing nature of the learning process in a way in which pre-determined questions cannot; 5) scaffold student learning by identifying students' scheme and building upon it; 6) feel confident that all students have the opportunity to see an idealized version of assignments required that model products of the highest standard.

Benefits to Students

The use of a Web site to post student work provides positive reinforcement for the student who created the work as they see their finished product published to a wider audience. As one student indicated "*Your offer to consider my project for publication on your site has motivated me to a higher sense of purpose. I only hope that I can produce a project worthy of your consideration*". Another student who constructed a History/Social Science interactive tour on the Web for EDUC 539 wrote "*I wanted to let you know that the class I took from you recently serviced me here at work. Along with a colleague I was invited by A&E's 'The History Channel' to write K-12 curriculum for one of their films "The Lincoln Assassination". The curriculum will go out to K-12 teachers all over the country when they order any of the films.......*". Additionally, the display of on-line student work tangibly demonstrates to subsequent students what the instructor's expectations are for a given assignment and gives them a dynamic model to emulate in their own work.

Disciplined inquiry relates to the discovery of authentic and complex components to any concept or research topic (Bruner, 1990). EDUC 539 students engaged in disciplined inquiry through the multiple links to theory and teacher based products provided on the Web module. As one student indicated "*By the way I love the web page especially the ERIC link. It is a dream come true!!! Thanks a million*." Another student in EDUC 539 designed a Web site for History/Social Science teachers and their students. The EDUC 539 student created a tour that provides the audience of high school teachers and their students access to historical links containing a variety of resources such as artifacts, museums, architectural structures, artists and their paintings or musical pieces. This EDUC 539 student used the disciplined inquiry model provided to him by the EDUC 539 interactive Web module to create such a product for high school teachers and their students.

Email Analysis

An analysis of approximately 40 Emails over the course of two semesters revealed that 41% were related to assignments and gaining a better understanding of instructor expectations, or exploring possible approaches to assignments, 24% expressed reflective or critical thinking regarding classroom concepts or discussions, 20% were exchanged in support of group projects, 7% provided additional information to share with classmates/instructor, and 7% dealt with outside experts. An example of extended classroom discourse that demonstrates critical analysis and reasoning can be seen here, "*A good discovery lesson seems to hinge a lot on the teacher--although one of the main criticisms of discovery learning is that the teacher's role is too ambiguous. Our favorite behavioralist, B.F. Skinner describes discovery learning as a method 'designed to absolve the teacher from a sense of failure by making instruction unnecessary.(B.F. Skinner, The Technology of Teaching, p.109)'.......Skinner creates a slippery-slope type of argument. In fact, he virtually equates a student's 'discovery' as requiring the same amount of genius as that of the original discoverer. Thus, when a student may be set up through a tactful curriculum to discover, say, the concept of a heliocentered solar system, that student would have to make the same conceptual leap as did Galileo. I think it's all a matter of designing the discovery unit in such a way that valuable insights are virtually inevitable. That's where a clever teacher comes in; one who is able to provide enough pre-reading and who is also adept at de-briefing the class at, say, the end of a simulation. These and other scaffolds can help the non-Galileos to see farther and with more clarity than they would on their own, while also preserving (at least superficially) their intellectual independence. To those who claim the discovery approach is worthless, let them be reminded of Einstein's great flash of insight: a mental picture of a man falling off a rooftop spurred him into developing the Theory of Relativity.*" The use of e-mail seemed to open up a more comfortable means of communication for some students who were more reticent to ask questions or share ideas in the whole class context, and it provided the time needed

for discussion outside of the class context. As one student explained, "*E-mail provides a great discussion forum as we have time to present ideas which would not be aired in class due to constraints of time*".

Survey Data Analysis on the Utility of the Web Module Features

Additional pre-analysis was done based on a pilot survey of EDUC 539 students who had been exposed to the interactive Web module during the Fall 1997 semester (Table 1). Out of those students who responded to the survey, 100% accessed the Web module outside of the classroom environment. The elements of the Web module which students found most valuable were (in decreasing order) links to references (ERIC, learning theorists, etc), interactive mid-term, lesson plan examples, learning project examples (samples of student work from previous semesters), and lecture notes. Students were also asked to describe aspects to the Web module they found difficult; this information is described in the Recommendations *and Future Research* section that follows.
Ê

Did you access the 539 Home page outside of the classroom environment?	100% Yes
On a scale of 1 to 5, with 1 being "Of No Use" and 5 being "Extremely Useful", how would you rate the utility of the web page?	4.2
Utility of Lecture notes?	4.5
Utility of Critical Thinking questions?	4
Utility of Lesson plan examples?	4.6
Utility of Learning project example?	4.1
Utility of Links to local school district sites?	3.1
Utility of Links to standards?	3.7
Utility of Links to Reference sources (ERIC,learning theorists, etc)?	4.7
Utility of Link to GMU E-mail/online account establishment?	4.1
Utility of Interactive mid-term?	4.4
Did you take the interactive mid-term quiz?	91% Took it
On a scale of 1 to 5, with 1 being Extremely Difficult and 5 being Extremely Easy, how would you rate the ease of access to the web page?	4.3
On a scale of 1 to 5, with 1 being "Of No Use" and 5 being "Extremely Useful", how would you rate the ability to communicate via E-mail?	4.7
On a scale of 1 to 5, with 1 being "Not At All Comfortable" and 5 being "Extremely Comfortable", how would you rank having to submit your learning project contract via E-mail?	4.1

Table 1: 1997 Fall semester student survey assessing the utility of the interactive Web module features. 85% of the students in the course responded to the survey; 55% were female, 27% male, and 18% were unspecified. 36% were of the age 21-30, 18% were 31-40, 9% were 41-50, and 37% were unspecified.

Recommendations and Future Research

The student survey also highlighted some technical problems that instructors might encounter, or might seek to avoid. Although the Web/technical environment is rapidly moving toward complete interconnectivity, there is still an array of hardware and software in use and some incompatibilities are almost inevitable. As a result of this initial survey, downloadable files were placed on the ftp server as rich text format *(rtf)* and the lecture notes on PowerPoint were converted to html, which allowed the files and lecture notes to be read by Macintosh computers as well as all word processors. Changes were made to the Web module that considered how students could be taught the interface elements of the Web module, and how students could benefit from the Web module even if they did not have a computer at home. Students were given an Internet lesson during the first class. Additionally, the instructor avoided posting assignments only on the Web, and critical thinking questions and lecture notes were posted in the beginning of the course to enable students the time they needed to access a computer from a University lab or public library. The instructor created and utilized the Web module for components of the learning process that would otherwise not be readily available to students without this medium such as lecture notes, streamlined searches by topic, and examples of former students' work. Adults who have difficulty coming to the University outside of class

time, can take advantage of the opportunity to view former students' projects without physical time restrictions. It is equally important to recognize that the integrity of the classroom learning environment for activities such as collaborative learning and personal rapport building need not be lost once technology has been integrated as an instructional tool. Instructors will want to consider the logistics of the classroom in order to maintain a collaborative and personal learning environment.

A research study design is being developed that would assess student learning over the past years of participation within this interactive Web course module. Additionally, data is currently being analyzed to assess whether or not participation within an interactive Web module affects attitudes towards and intent to use technology as current or future teachers.

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Teachers as Designers of Collaborative Distance Learning

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Abstract: This paper describes a theoretically based approach to the design of collaborative distance learning environments by subject experts. There is an obvious growth in the use of distributed and online learning environments. There is some evidence to believe that collaborative learning environments can be effective, especially when using advanced technology to support learning in and about complex domains. There is also an extensive body of research literature in the areas of situated cognition and problem-based learning that provides a theoretical perspective for the design of such learning environments. What is lacking are intelligent support tools to make it possible for subject experts (teacher-designers) to be more intimately involved in the design and implementation of collaborative distance learning environments. I provide a description of such design tools, explicitly drawing on a socially-situated view of problem-based learning in technology-mediated environments. I conclude with an illustration of the tools as applied by teachers to the domain of environmental education.

Introduction

Technology-based learning environments are growing in number and prevalence at an unprecedented rate in spite of continuing debates in the academic literature with regard to their learning-effectiveness, impacts on organizations, and overall utility to society (see, for example, Carter 1997; Clark 1994; Kozma 1994). As a consequence, there are many investigations into how people learn using new technologies, and these studies are, in turn, causing much discussion with regard to foundational issues in learning theory and instructional design. One challenge we face is to make sense of some of these changes so that we can make effective use of new technologies to support learning and instruction. It is my hope in this paper to move this discussion forward by providing an easily accessible design framework for technology-mediated learning environments. I intend this framework to be well-founded in learning theory and to have strong implications for designing learning environments for what I regard as a challenging domain: learning in and about complex systems. Moreover, I shall emphasize the need to empower teachers to become designers of such environments. I proceed by briefly identifying and reviewing relevant learning theories and current tools. I shall then establish a unifying perspective with clear design and evaluation implications. This unifying perspective will then become the basis for the use of tools. I conclude with an illustration of this framework and indicate other instances close in kind and spirit to what I present here.

Theoretical Perspective

How do people come to acquire complex skills and knowledge? I ask this question in order to identify relevant assumptions and highlight its complexity. First, much learning research proceeds on the following assumptions: (1) learning is a natural, human activity; (2) the unit of analysis for learning effectiveness is an individual human learner; and, (3) learners are rational. An additional assumption prevalent in the educational research community is that instructional design is primarily a prescriptive enterprise forming a bridge between descriptive learning research and practical development of learning environments (Reigeluth 1983).

There is practical value in adopting this research perspective. By varying the instructional methods used in certain conditions, one can measure outcomes and study the effects of those methods on learning outcomes. If enough data is collected, one then hopes to be able to establish a strong argument for the desirability of a particular method given certain learning conditions, thus prescribing how one ought to design instruction to achieve desired outcomes. In this perspective, learning is a natural process, and it is theoretically possible to identify how various types of learners engage in this process and take those differences into account in the design of instruction. Learners are rational in the sense that they are goal-driven, purposeful agents with the ability to identify and select reasonably

efficient means to achieve goals. Typically, conditions are held constant and various interventions (instructional methods instantiated in particular learning environments) are investigated. Learning outcomes or effects are then measured on individuals.

Such a research paradigm has produced many useful findings, so it should not be discounted. For example, by emphasizing the rationality of learners, designers are able to facilitate the identification of learning goals and support activities likely to satisfy the achievement of those goals. This line of research emphasizes intentional learning, and generally ignores incidental learning, to which it is more difficult to apply the conditions-methods-outcomes model. Since it is assumed that learners will want to achieve goals efficiently, designers can then specify how and when to provide learners with informative feedback on progress towards those goals.

I shall refer to this as the atomistic perspective because it is characterized by an atomistic view of learning, both in terms of units of learning (very specific and discrete conditions, methods, and outcomes) and in terms of learners (typically focusing evaluation on individual learners, even when the setting involves cooperative learning). The atomistic perspective can be contrasted with what I shall call the integrated perspective (Spector 1994, 1995). The integrated perspective begins with a view of a person as a member of a society or language community. The overall goal of a society or language community typically involves a strong survival element, although this is quite often not made explicit. Living consists of working and learning, which are viewed as essentially collaborative efforts to achieve commonly held goals. From this perspective, individuals might manage to acquire extremely high levels of performance at particular tasks while the larger social group consistently falters. This would not count as effective learning from an integrated perspective.

There are comparisons to a team perspective when thinking of learning from an integrated perspective. A team may have several outstanding players, leading the league in certain categories, while the team is in last place. This is not a satisfactory situation, especially from the team's point of view. One can further imagine a team locked into poor overall performance by paying one star player a very high salary. This might prevent the team from paying higher salaries to others, and it may also foster jealousy and resentment within the team. While the star player may draw in large crowds and the team's owners may prosper, the team's poor performance may further decline, even when a second star player is added. One should be careful not to carry the sports analogy too far, however. Learning organizations and societies are not necessarily competitive with other such organizations. Moreover, membership criteria and reward mechanisms are entirely different. The point is to suggest the need to consider a more integrated, holistic view of learning, especially with regard to learning in and about complex domains.

Complex Domains

From a research perspective, complex domains present significant challenges, both for designing effective learning environments and for determining factors which contribute to learning. From a social perspective, these domains present significant challenges for the future well-being of our species on this planet. We have serious problems to confront if we are to survive, including worsening global environmental problems, persisting regional and ethnic conflicts, and wildly fluctuating economic conditions. Can we become better prepared to meet these challenges? How? Complex systems can be depicted as a collection of inter-related items, which are characterized by internal feedback mechanisms, nonlinearities, delays, and uncertainties (Sterman 1994). These systems typically exhibit dynamic behavior, especially in the sense that how they behave has an effect on internal relationships (the structure of the system), perhaps strengthening one of the feedback mechanisms (e.g., the owners' proceeds due to acquiring a star player reinforces that mode of response to declining profits, as opposed, for example to improving overall performance.). This change in internal structure in turn has consequences for how the system will behave in the future; for example, the team may perform even more poorly as existing players resent the special treatment and salary given the star (Davidsen 1996).

Our inability to dealing effectively with complex systems is well documented (see, for example, Dörner 1996). Deep understanding of complex systems, characterized by effective decision making across a wide variety of changing conditions, takes years to acquire, and appears not to be easily acquired in spite of concentrated education and training efforts (Dreyfus & Dreyfus 1986). Why have we failed to improve our thinking skills in complex domains in spite of persistent and serious efforts? In part, we have not fully understood relevant psychological and sociological factors. In part, we have not fully integrated relevant principles about human learning into design praxis. We should have learned that humans have difficulty in estimating the effects of accumulation over time, in predicting the effects of delays, and in calculating nonlinear outcomes (Sterman 1994). We should have learned that even well-intentioned persons tend to focus on local problems as opposed to whole systems (even when told that a holistic understanding is essential for solving particular problems), that people may become cynical and overlook possible solutions when their first attempts fail, that people do not communicate effectively in crisis situations, and

that inferring underlying system structures from externally viewed system behaviors is not an easy task (Dörner 1996).

In short, instructional scientists have not fully understood the socially-situated learning perspective and its implications for human learning in and about complex systems. There is a great deal of discussion about situated, problem-based, and collaborative learning, but we are missing critical pieces of a design framework. We lack a well-articulated design framework with sufficient detail to take us from a socially-situated, problem-based, collaborative learning perspective to the design of a particular learning environment for a particular subject domain. The closest such approach I find is cognitive apprenticeship (Collins 1991). I regard this work as an extension to that approach.

Theoretical Foundations

The theoretical foundations for this effort come primarily from a socially-situated learning perspective, drawing heavily on the views of Bruner (1985), Lave (1988), Piaget (1970), and Vygotsky (1978). Within this perspective, learning is viewed as an active process of knowledge construction in which learners are typically involved with other learners in authentic, problem-solving situations. The need to learn created by a realistic problem provides motivation, and interaction with other similarly immersed learners provides facilitation. I am favorably inclined to Sfard's (1998) view that emphasizes the need to take into account both an acquisition (static knowledge objects with learners acquiring expertise) and a participation metaphor (dynamic knowledge objects with learners as active apprentices). Much higher order learning relies on knowledge and associated learning activities that might best be supported within the acquisition view. However, to progress beyond competent performance and become a proficient expert (Dreyfus & Dreyfus 1986), I believe that the participation metaphor with its emphasis on active learner participation in socially-situated and problem-oriented settings is crucial.

Vygotsky's Cultural-historical Theory and Activity Theory

For Vygotsky (1978), human mental functions appear first as inter-individual and later as intra-individual. This process involves the use of socially developed tools. The unit of analysis for human activity and for human learning is the mediated action of an individual. This broadens the unit of analysis identified earlier from just the individual to include an artifact with which an individual interacts. Leontiev (1975) expanded Vygotsky's cultural-historical theory to an activity theory approach to human interaction. From this perspective, reality consists of mediated, social activities, among other aspects. For Leontiev, the unit of analysis was extended to include the notion of a collective activity, something done by a community with a purpose (which need not be consciously recognized). This motive or purpose is composed of individual actions were directed toward a common goal. An individual's mediated actions could still be analysed, but there was now a necessary social dimension (being part of a collective activity) which was used to understand individual activity. Davydov (1988) applied Leontiev's activity-theoretical approach to the learning process and developed a psychological theory of learning activity which focused on purposeful and joint activities of teacher and learner in the social context of development. From this perspective, the aim of a learning activity is to teach study skills that enable learners to think on their own. Margolis (1993) suggests that within this perspective the computer can have one of two roles: as a tool for the acquisition of knowledge and empirical facts, or as tools for the development of children's thinking (i.e., as tools for reflection or metacognition). I think both roles are possible, even within the same learning environment, but I do agree with Sfard (1998), Dörner (1996), and others that when the computer is used to support higher order learning in complex domains that supporting active participation and reflection are especially important.

Socio-cultural theories of learning and teaching, as inspired by Vygotsky, have addressed the instructional use of computers. Some of these include cognitive apprenticeship, cognitive artifacts, distributed cognition, learning by expanding, scaffolding, situated learning, and so on. In short, the theoretical heritage for collaborative online learning and distance learning is quite rich.

Collaborative Learning

Collaborative learning is a collection of perspectives that emphasize the following (Fjuk 1995):

1. Joint construction of knowledge (e.g., joint problem-solving by mutual refinement).
2. Joint negotiation of alternatives through argumentation, debate and other means.
3. Student reliance on both fellow students as well as teachers as learning resources.

Collaborative learning is based on the notions of 'socially shared cognition' (Resnick, Levine & Teasley 1991), of 'distributed cognition' (Salomon 1993), and of 'jointly accomplished performance' (Pea 1993). The majority of research into collaborative learning has focused on collaboration between physically present actors and has generally focused on whether and under what circumstances collaborative learning was more effective than individual learning (Dillenbourg, Baker, Blaye & O'Malley 1996). More recent efforts, however, have been directed towards a more process-oriented account of collaboration where the focus is on the role that variables such as group

size, group composition, and communication media play in mediating interaction. Again, this is a clear indication that the unit of analysis has been appropriately enlarged far beyond the individual learner.

I have now collected several design principles which form key features of a design framework, and I have shown their linkage to learning theory. These principles might be summarized as follows:

- Provide support for the joint construction of knowledge objects and for the joint construction of problem solutions. This can be accomplished by providing learner-extensible databases, by providing learner-modifiable simulation models, by supporting learner-learner and learner-tutor collaboration in making changes and extensions to existing knowledge objects, and by supporting learner-learner and learner-tutor reflection on outcomes of those modifications.
- Provide tools to support joint negotiation of alternatives. Commenting tools are a beginning. Allowing changes to be tested when appropriate is also important. It is especially important to allow learners to try out alternative simulation models, to observe results, and to support learner-learner and learner-tutor discussion and analysis of those results.
- Provide both public and private feedback support mechanisms for learners while emphasizing to those intelligent agents providing feedback that it is important for learners to gradually improve their own ability to monitor and assess progress toward desired goals.

In short, this framework aims to support both individual work and collaborative activities, and it especially aims to support the development of collaborative learning communities.

Computer Supported Collaborative Learning (CSCL)

The important implications for CSCL that emerge from these theoretical foundations include the view that the computer is a mediating tool that needs to be seen in the context of the entire learning environment within which it will be used. That context includes the instructional setting, the presence or absence of a teacher, the role of teachers and tutors, the role of the learner and other learners, the curriculum, the organizational setting, etc.). Contemporary theories for the instructional use of computers need to address not only the role of the teacher in the classroom, but also the role of the computer, the design and choice of instructional software, and interactions between the teacher, student and computer. In short, one must describe both the content of the microworld as well as the organization of various learning activities. The microworld represents the content to be learned (i.e., a practical skill or theoretical concept) which is a concrete school subject to be mastered. Dörner (1996) and Sterman (1994) have a broad view of the microworld, viewing it as a facilitating means to help learn about a broader subject matter. The interaction modes needing organization and control by designers include supporting student interactions with the computer and interactions between the teacher(s)-computer(s)-student(s).

Distance Learning

Distance learning evolved from a need to ensure equal access to education for all students (Bourdeau & Bates 1997). The most obvious feature of distance learning is that students and professors do not all meet at the same place and time. Individual learning, individual tutoring and asynchronous communication are typical features of distance learning, requiring careful instructional design, and a strong student support system. These features, however, do not necessarily dominate in the design of an effective distance learning environment. Many variations of *telepresence* needed to be taken into consideration, including the sense of telepresence in a virtual meeting, the sense of telepresence in interactions with rich multimedia environments, and the sense of telepresence in extensive human collaborations with online knowledge objects and virtual worlds (e.g., online microworlds).

Coordination Theory

Salomon's work on CSCL (Salomon 1992, 1993) provides the most complete approach to the study of CSCL. Salomon's focus is on mediation in CSCL, which is a key issue in collaborative distance learning. In his view, collaboration involves interdependencies, sharing, responsibility, and involvement. Genuine interdependence is characterized by Salomon (1992) as follows:

- the necessity to share information, meanings, conceptions and conclusions;
- a division of labor where roles of team members complement one another in a joint endeavor and the end product requires this pooling of different roles; and,
- the need for joint thinking in explicit terms that can be examined, changed, and elaborated upon by peers.

Salomon's emphasis on genuine interdependence between team members raises the following question: How can such interdependencies be specified and supported in a collaborative distance learning situation?

Malone and Crowston (1994) describe coordination theory as focused on the interdisciplinary study of how coordination can occur in diverse systems. Coordination theory provides a means for specifying (inter)dependencies between, and among, actors, tasks, and resources by identifying a *dependency type* (e.g., shared resource) and a

coordination process (e.g., group decision making) for managing the dependency. In their work, coordination is defined *as managing dependencies between activities* (Malone & Crowston, 1994), hence they have focused on dependence between activities. Drawing on ideas about activity coordination in complex systems from disciplines as varied as computer science, linguistics, psychology, economics, operations research and organization theory, they present an analysis that characterizes the basic processes involved in coordination (Wasson & Bourdeau 1998).

A Design Framework for Collaborative Learning Environments

A relevant starting point for the design of these learning environments can be found in the computer supported collaborative learning (CSCL) literature. The CSCL perspective focuses on the use of information and communications technology as a mediating tool within a collaborative learning framework of learning. CSCL emphasizes an understanding of language, culture and other aspects of the social setting (Scott, Cole & Engel 1992) and can be traced in part to a socially-situated perspective of learning (Lave 1988; Vygotsky 1978), as I have already indicated. The common and unifying notion of situated and shared cognition emphasizes the larger environment within which learning takes place. Learning is viewed in part as entering into a "community of practice" with a shared language and understanding. The problem of establishing such a community in distance settings is a critical design aspect that has been poorly understood and not especially well implemented in practice.

An example of an approach which aims in this direction can be found in the VIRTUE Program, a collaboration of three universities in the domain of marine biology and environmental education (see the following web address:). One interesting line of research involves public school children from the Baltimore area. Children are brought to the University of Maryland research facilities in the summer and offered an opportunity to help construct a database for bio-diversity in Cheseapeake Bay. The students learn about specific aspects of bio-diversity, how to collect data, how to interpret data, and how the data is inserted into the database and used by professional environmental engineers. These students become members of the community of practice by collecting and interpreting data and then by helping build the database. They become contributors to and partial owners of an important environmental database.

This design methodology is based on cognitive apprenticeship (Collins 1991). The overall learning approach is collaborative in nature. The specific view of collaboration is that tasks and activities should be realistically arranged and mediated in ways that naturally involve and recognize particular interests and skills of learners (Salomon 1993). In the marine bio-diversity example, students work in small groups of two and three and rely heavily on the assistance of graduate assistants and teachers to check their work. Students understand the significance of the activities in which they are engaged and recognize their contributions as valued and significant.

Distance learning environments can and should be designed so as to support these interdependencies. The fluid mediation of such collaborative learning activities is a major challenge for online learning environments. Mechanisms to support synchronization, exchange of information and documents, and access to tools and services, all need to be as transparent as possible so as to minimize the cognitive overload associated with new tools and technologies. Viewing learning environments from a coordination theory (Malone & Crowston 1994) perspective offers a means of understanding the inter-relationships between actors and entities and how these relationships can and should be supported. I argue that such a model should inform: (1) the instructional design of learning scenarios; (2) the specification of the design of the online learning environment; and, when possible and appropriate; and, (3) the design of intelligent agents to mediate and co-ordinate learning activities between and among learners and tutors.

Concluding Remarks

I have tried to identify useful and theoretically grounded design principles for the creation of distance learning environments for complex domains. I have suggested the following initial principles:

- Provide support for the collaborative construction of knowledge objects, for the collaboration construction and analysis of problem solutions;
- Provide tools to support negotiation of alternatives;
- Provide both public and private feedback support mechanisms;
- Provide mechanisms to share and exchange information, objects, views, etc.;
- Facilitate a meaningful division of labor;
- Support joint, online thinking, commentary, etc.;
- Include meaningful learning scenarios;
- Design authentic problems and legitimate cases as the basis for learning activities;

- Take into account the entire learning environment;
- Support mediation among all the participants; and,
- Foster a sense of a collaborative learning community.

It is premature to argue that such a framework will produce significant and long-lasting learning effects. Based on existing data collected on teacher-designed learning environments and from data reported on some of those which adopt similar approaches, I believe that there is great promise in designing distance learning environments from a socially-situated learning perspective with heavy emphasis on collaborative learner participation in the creation and modification of knowledge objects and artifacts. Furthermore, I am convinced that teachers can participate much more actively in the design and implementation of such learning environments.

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Taking ID On-line: Developing an On-line Instructional Design Course

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Abstract: Educators in higher education are increasingly being called upon to design, develop and deliver courses via the World Wide Web. Although reasons for the strong push to develop on-line courses are varied, it is clear that the perceived need for such courses is steadily increasing. Also needed are prescriptions for creating courses that are dynamic, interactive and timely. The purpose of this article was to explain, in detail, the process of developing a Masters-level instructional design course for delivery on-line. Rationale behind the need for such a course, development procedures, successes/failures, and prescriptions for future developers will be discussed.

Introduction

Increasingly, higher educators may find themselves in a new situation. They may be asked to design and develop courses for delivery via the World Wide Web. The reasons for increased pressure to develop these courses are varied. However, in an article by Gubernick and Ebeling, (1997) the authors suggest that quite possibly, universities will have to change as we know them. According to the authors, in 1994, Peterson's Guide listed only 93 schools that delivered instruction via the web. Gubernick and Ebeling state that today, there are over 760 course offered via the web with over 55% of U.S. four-year colleges and universities offering on-line courses.

In order for universities to compete for students, administrators recognize the need for change. For example, Cagney (1997) suggests that no type of college or university will be spared from this trend. Even Christian universities could be threatened if their students can take a significant portion of their courses on-line.

In an article in the Chronicle of Higher Education, the author discusses the fact that even the "more elite" universities may be jumping on the bandwagon. Universities such as Yale, Rice, and Duke are considering offering distance courses ranging from continuing education courses for alumni to distance-based graduate courses to general courses to the public (Blumenstyk, 1997).

Background Information

The state from which the on-line course was delivered is in the top ten in terms of total area yet the population centers are scattered throughout the state. In addition, in order to meet the changing needs of students, the administration at the university has placed increase importance on the development of courses for delivery via the web. Faculty members who design and develop web-based courses have received grant money, may be able to receive release time in the future and it may have a positive influence on the process of tenure and promotion.

This author used the ADDIE model of Instructional Design to design and develop an Instructional Design course for on-line delivery beginning in the Summer of 1998. This is the first of the core courses in the Masters program to be delivered on-line. The dean of the college as well as the chair of the department were extremely supportive of the design of this course.

Analysis

The students who take courses Instructional Design are usually Masters students in an Instructional Technology program located in the mid-west. The course is also a requirement for certification in a Library and Information Systems program and an increasing number of those students have enrolled in the class. They are

usually in-service or former K-12 teachers and have a range of technical expertise. This is a required course yet most students are self-motivated and enjoy learning about the systematic design of instruction. Specific technology to be used by students is not emphasized—students have designed instruction using print-based media, projected media and hypermedia.

This course presents a systematic method for the planning and development of instructional programs. In addition to examining the research supporting contemporary methods of instructional design, students will apply instructional design principles to the development of an instructional lesson.

Upon completion of this course, students will be able to demonstrate skills, which will assist them in becoming professionals who, are critical thinkers, creative planners, and effective practitioners. Each student will be expected to:

- Describe the basic components of instructional design.
- Summarize the research supporting the various elements of systematic instructional design principles.
- Develop an instructional plan that includes learner and task analysis, instructional design, instructional materials development, a strategic plan for the implementation, and a plan for formative analysis (Summer '98)
- Produce an instructional lesson according to the systematic plan developed (Summer '98)
- Analyze and develop cases in Instructional Design (Fall '98)

Design

The design of this course has literally taken several months. This author began thinking about creating a web-based course in the Fall of 1997. The biggest obstacle to this course was having enough material available on-line without risking violating copyright laws. Fortunately, there were many sources available on-line. It is extremely important to stress that this author also believes it is important to ask permission to use these sites as a part of the class. The URL's for sources will be included in the presentation pending author approval and available through the following website: http://www.emporia.edu/idt/id/design.htm.

This course was offered as a traditional class in the fall of 1997. It was important to this author to keep the content in the distance class as close as possible to the content in the traditional class. Although the class used the ADDIE model as the basic model of Instructional Design, many other models were discussed in class. Much of the class time was used to discuss the "pro's and con's" of several traditional and non-traditional methods of designing instruction. Thus, it was important to set up a listserv for the purpose of class discussion. Examples of questions and responses will be included in the presentation and available through the following website: http://www.emporia.edu/idt/id/design.htm.

Development

This author used Adobe Pagemill 3.0 to create the web-site for class. The site itself consists of three frames: a "contact" frame (with e-mail and street address information plus phone numbers), a "menu" frame (with course syllabus, questions of the day, on-line resources, and directions for subscribing to the listserv), and a "main" frame which contains information loaded from the menu. A demonstration of this website will be given during the presentation and available through the following website: http://www.emporia.edu/idt/id/design.htm.

A listserv was also created to handle the class discussions. These discussions took place on a regular, almost daily basis during both summer and fall semesters (deadlines were emphasized) and were based on the essential elements in Instructional Design, models of Instructional Design, and outside readings.

The students were required to submit projects via e-mail during the summer '98 semester. There were a total of seven small projects due during the course of the summer session. These projects were designed to represent each of the phases of instructional design from Analysis to Evaluation. "Analysis" was broken down into three separate projects: Needs Assessment, Learner Analysis and Task Analysis.

During the fall semester, in lieu of projects, students were required to analyze cases in small, pre-assigned groups. Students were directed to read the cases posted to the website, develop their own conclusions, and then submit them to the group. From there, the group would try to reach a consensus of opinion regarding the questions posed.

Implementation and Evaluation

This course was delivered in the summer and fall of 1998. Evaluations as a whole were favorable for the summer semester, but it was evident that the process of submitting projects via e-mail was quite frustrating, both for

the instructor and the students. Due to the difficulty in sending and receiving projects via attachment, the course was changed to a case-based course for the fall '98 semester.

Using cases for analysis has proven to be quite rewarding. This author chose to create new cases due to the fact that the case study textbook of choice, "The ID casebook" (Ertmer & Quinn, 1999) was not available for review until just prior to the start of the fall semester. There were a few problems with the clarity of directions in the cases; missed links, making assumptions, not asking questions, etc. However, the problems did not seem to interfere with the students' knowledge of the case. The problems will be corrected in time for the summer '99 class.

Although the results of the evaluation for the course during the fall semester are not available at this time, all indications are that the student evaluations for the fall will exceed the evaluations for the summer semester. Student comments have been, on the whole, extremely favorable.

Conclusion

The importance of designing web-based instruction is clear. University personnel must prepare for the inevitability that courses delivered traditionally may need to be delivered via the World Wide Web in order for the college or university to remain competitive. What the exact process of conversion looks like for courses such as Instructional Design remains to be seen.

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Developing an Internet-Based Distance Education Program: the Planning Phase

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Abstract: An increasing number of colleges and departments in higher education institutions, including teacher education programs, are considering or have started developing distance education programs to be delivered on the Internet. From a needs assessment perspective, this paper examines a comprehensive array of practical issues and questions (particularly related to services and support available to students and instructors) that ought be addressed and resolved by both the administration and the faculty during the planning phase.

1. Introduction

Tracing its root since 1890, with more than 100 million Americans who have studied by distance education (Distance Education and Training Council [DETC], 1998), distance education has now gained general acceptance in American higher education (Moore & Kearsley, 1996; Porter, 1997; Saba, 1997).

In 1994, Holland, vice chancellor of the University of Exeter, predicted that "by the year 2020 every education and training programme leading to a qualification or a credit towards one will be available in three modes: full time, part time, and through distance learning" (Wild, 1994). Current research has shown that over one-third of all four-year public institutions and nearly 30 percent of all four-year private institutions offer complete degree programs through distance education; this is due to increasing demand for educational programs delivered at or near the workplace using a variety of media (University Continuing Education Association [UCEA], 1998).

While the costs on personal computers are being decreased drastically ("PC Prices," 1998), over one-third of all American homes now have a personal computer, and it is predicted that by the year 2000, nearly half will have PCs (UCEA, 1998). With the increasing population of Internet users, about 41 million adults (UCEA, 1998), Internet-based course delivery is commonly adopted by many distance education programs (Khan, 1997; Moore & Kearsley, 1996; Porter, 1997).

An increasing number of on-line teacher education programs are being offered by higher education institutions such as Indiana University, New School for Social Research, UCLA Extension, and University of Missouri-Columbia, just to name a few. However, Internet-based (or on-line) programs do not just happen. It is suggested that creating such programs require cross-campus, collaborative efforts among the administration, faculty members, other departments, and staff and support services personnel (Distance Learning Resource Network [DLRN], 1998).

For teacher education programs that are planning to deliver on-line course offering, this paper addresses considerations and questions both administrators and faculty members may encounter when designing and developing on-line courses.

2. Needs Assessment in the Planning Phase

A number of questions encountered by administration and faculty members in the initial stage of distance education program development includes: Is there a need for a distance education program from our admitted students? How will new and/or global students be recruited? Who in the department will teach on-line courses? Are faculty prepared to teach on-line courses? How do we address the special needs of students at a distance? Important in this planning phase is the needs assessment which should be conducted to determine the nature of the new program and how questions can be resolved (Dick & Carey,

1996; Harasim, Hiltz, Teles, & Turoff, 1997) and to assist decision makers in clarifying an initial program focus (Boyd, 1992).

In his needs assessment model, Rossett (1987) defines five essential informational components that are actuals, optimals, feelings, causes, and solutions. To create a distance education program via Internet delivery, the gap (or the need) between actuals (the current program) and optimals (the new distance education program) must be bridged.

3. Issues and Questions to be Addressed

In developing a rationale for goals, objectives and curriculum of a distance education program, a needs assessment ought be conducted to identify and examine these challenging issues: student profile, student services, testing, technologies and media, faculty training and support, technical support, and economic factors.

Student Profile

Distance learning opportunities increase education availability and provide students the flexibility to pursue lifelong learning. Some findings of studies reveal that distance students tend to be employed, have less prior education, are older, and live relatively far away from an institution that offers the program they need (Field, 1982; Keegan, 1996). In the efforts of recruiting students, examining the following characteristics of the student body helps shape the distance education program:

Local vs. global: If there are international students applying for the distance education program, the program will need to collaborate with the admissions unit on campus to create or refine admissions procedures and policies for foreign students (such as foreign credential evaluation). Also, local marketing strategies differ from global.

Degree seeking vs. non-degree seeking: If students are working toward a degree, will they have to come to campus to take courses that are not available in the distance education program? Remote students might have difficulty leaving home to take individual courses.

Student Services

When students are enrolled in on-line courses, they must have access to the services available to on-campus students and applicable to distance students. Logically, distance students will have to pay for the fees for the services they will use. The department that offers on-line courses will need to consult and collaborate with various units on campus to ensure that distance students will receive the services they pay for.

Registration: Once distance students are admitted, easy access to course registration and payment, such as telephone registration and preferably on-line registration in addition to postal mail correspondence, should be made available.

Bookstore access: Although textbooks can be purchased via commercial on-line book retailers, availability and prompt delivery might not be always guaranteed. Therefore, the campus bookstore will need to accept orders by mail, fax, phone, or Internet access and provide shipping service.

Library access: Distance students should be able to access the on-line catalogs of the campus library and request materials from the library.

Computing: Basic use of the Internet such as e-mail and the Web should be introduced and made available to distance students. Besides, the campus computing unit has to be clear on whether computer software can be sold to distance students at the academic prices based on the contracts signed with the software or hardware vendors.

Testing

When it comes to evaluating students' learning outcome, testing security must be addressed.

Faculty members might need to consider revising their testing methods used in face-to-face classes.

Objective vs. subjective: Objective tests can be created, administered, and immediately graded via the Web by using some Web-based testing package. Feedback can be provided right after an answer has been submitted. Faculty members will have to grade subjective tests which can be submitted by e-mail.

Proctored vs. open-book: Policies and procedures on arranging a proctor should be made explicit to the students. Sometimes it might be difficult to identify the qualifications of a proctor when he or she resides in a remote state or in a foreign country. If a proctor is not required in an open-book test, there is almost no way of authenticating whether the person taking the test is indeed the student enrolled.

Assessment strategies: Faculty should consider evaluating a multiplicity of evidence of students' learning outcome, such as participation, writing assessment, portfolio assessment, and teacher-based assessment (Harrasim, Hiltz, Teles, & Turoff, 1997). Requiring students submitting multiple drafts of their work is another way of checking their learning progress and reducing the chance of plagiarism.

Technologies and Media

Depending on the content of each course, the computer literacy level of the faculty assigned to teach an on-line course, and the teaching styles of individual faculty members, different technologies and media would be selected although the primary course content delivery might be Web-based.

Internet technologies: E-mail and class e-mail discussion list are commonly used in most on-line courses and some face-to-face courses as well. Other Internet application software such as Web-based testing as mentioned before, client-server conferencing and messaging software, and even desktop audio and/or video conferencing software could be adopted pending on the availability of funding, technical support, and training.

Other media: Course packet that is composed of printed reading materials with copyright permission in addition to the textbook can be sent to the enrolled student. CD-ROM can be also prepared and shipped to students if there is a large amount of data or materials in electronic format. Preparation costs for such media might add to students' tuition and fees.

Requirements: Software, hardware and operating system requirements must be explicitly expressed to students. It could be assumed that lowering these technical requirements might generate more enrollment.

Faculty Training and Support

To ensure the quality of a distance education program, training and support for participating faculty are expected since distance education and using related technologies may be relatively new experiences to faculty members. For example, lesson materials uploaded to the Web are considered as one form of publication, and thus the faculty member must obtain copyright permission before including any copyright protected materials in the lessons.

Distance learning designer: The context-specific characteristics of distance education has generated specific pedagogical professions including the distance teacher, the content expert, and the distance learning specialist such as the instructional designer (Rekkedal, 1994). However, not every department can afford to employ a distance learning specialist to provide training and support to the faculty during the on-line course development process and during the ongoing teaching process, but if the institution is willing to have a distance learning specialist employed, he or she might be assigned to assist multiple academic departments.

Training: The faculty will need to understand and visualize the distinctions between traditional face-to-face education and distance education, characteristics of the distance learner, and pedagogical strategies specifically designed for distance learning. They will also need to learn how to use the technologies and media chosen for the Internet course delivery. Such training sessions would be provided by the distance learning specialist.

Other personnel: A program coordinator would be needed for marketing and management of the on-line program. A computer programmer who is knowledgeable in various Internet technologies and other forms of media production would be desired. If a faculty has a large enrollment such as 50 students in an on-line course, a teaching assistant would be helpful acting on such tasks as grading quizzes and

helping solve minor technical problems raised by students.

Technical Support

According to the Chronicle of Higher Education, a survey of 58 members of the Consortium of Liberal Arts Colleges (CLAC) indicates that the top issue for the majority of the polled institutions is providing adequate support for campus computing during a time of "increased expectations" by students and faculty members ("Computer Support," 1998). Likewise, such technical support is even more crucial for distance education programs.

Server maintenance: For courses that are delivered on the Web and that use e-mail and/or other client-server Internet application software, the servers must be well maintained and will be scalable when large enrollment arrives. Server down time must be minimized.

Help desk: No assumption that distance students have prior knowledge and experience in how to solve technical problems such as Internet connection, browsing the course Web site, or using certain software required should be made. If face-to-face training on using the technology is not feasible to distance students, help desk service ought to be in place. Regular hours of the help desk will need to be extended to accommodate distance students' needs because employed adult learners tend to focus on learning during evenings and weekends, and the help desk will need to consider providing service within national and international time zones.

Economic Factors

Last but not least, individual departments might need to secure funding if not granted by the campus administration. In an overview of cost analyses for both educational technology and the whole distance education program, Rumble (1987) addressed the question of when a distance education system is more expensive than a conventional system and when it can be less costly. Some institutions view distance education as a revenue generation channel despite of the initial implementation costs. For example, New York University has recently created a for-profit unit to market distance education.

Faculty: In some institutions, merit pay is provided to faculty for initial on-line course development, and a study shows that it is an extrinsic factor that influences faculty members to participate in distance education (Betts, 1998). Policies on the ownership of on-line courses vary, too. Penn State is splitting revenues with the faculty members who develop courses and their departments, whereas New York University will hold ownership rights for its online courses.

Human Resources: Funding to employ new personnel to support distance education programs is another economic factor unless there is an existing extension unit that offers continuing or distance education programs on campus and that would be capable of coordinating the new on-line program with individual departments.

Technology: The costs of implementing distance education programs vary because the cost for introduction of educational technology depends on the existing technology infrastructure in an institution (Harrasim, Hiltz, Teles, & Turoff, 1997).

Grant: When there is no local funding from the local institution, outside grants would be an alternative. For instance, over the past five years, the Alfred P. Sloan Foundation's Asynchronous Learning Network has made grants totaling nearly $27 million to institutions involved in distance-education programs.

4. Conclusions

The planning phase of the development of an Internet-based distance education program includes: recruitment of students, arrangements of services and technical support to distant students, test/examination arrangements, selection of appropriate technology and/or media, faculty support and training, and budget planning.

Administrators and faculty members ought to take the above issues into account during the planning phase in the on-line program development process. Indeed, Internet-based distance education is a new dimension of teaching and learning processes that might, in many ways, differ from the face-to-face

educational environments. Therefore, administrators will take appropriate actions to observe that coordinating efforts will be made across the campus and among various human resources in order to add this innovative dimension to the traditional campus, and faculty members will focus their energy on writing the content of the on-line course as well as teaching the course via the Internet.

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From Textbooks To Coursewares
---- On the instructional design

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Abstract: This paper stresses the importance of instructional design for classrooms and textbooks, describes the instructional design methodology for computer courseware, finally, raises some issues that are worth notice in instructional design for computer courseware.

With the approaching of the information age and the knowledge economy, teachers who are used to traditional ways of instruction are nowadays faced with new challenges: the aim of teaching is not only to disseminate the existing knowledge, but also to develop student ability in knowledge discovery, knowledge creation and lifelong study; the circumstances of teaching is not only face-to-face classrooms, but also the cyberspace of distance education in which teachers and students are linked by videoconferencing and internet; the responsibility of teachers is not only to deliver courses and to compile textbooks, but also to provide consulting services for lifelong study or to author computer courseware/lessonware for individual study. In one word, a teacher should be a guide by the side, not a sage on the stage. Coursewares and lessonwares are playing dominant role in distance education in the foreseeable future. Though a variety of coursewares are on the market everywhere, few of them can be adopted for formal educational purposes, as most of them could not meet the educational demands owing to unsatisfactory quality. The authors propose that all the authors of coursewares and lessonwares should made painstaking efforts in instructional design, as this is the key to improve their quality.

I Textbook Is The Blueprint for Classroom Instruction

1. From Instructional Effect in Classrooms

Classroom instructional activity plays a very important part in improving teaching quality, both teachers and students do wish that all the students have a good mastery of all the knowledge and skills taught in the class. As a matter of fact, the teaching process is an exchange of ideas and emotions between teachers and students, the student is a principal part, the teacher is a dominant part, while the responsibility to organize the classroom educational activity lies upon the teacher after all. How is it like in the teaching process could receive satisfactory outcome and effect? The authors propose that teaching process must be stressed on and be particular about scientiality, logic, heuristic and amusement.

Scientiality denotes what is taught is in accordance with the natural laws and social evolution of human beings, all the taught conceptions, theorems, definitions, formulas, curves...... are exactly correct, all the analysis, illustrations, inferences, experiments...... are rigorously made. Logic means what is taught is in accordance with the human cognitive laws and modes of thinking, students can be guided to master the taught knowledge and skills gradually and to infer from outward appearance to inner essence, from the shallower to the deeper. Heuristic stands for fostering students to sum up what they have learned themselves in order to grasp the essence, students can be trained to learn the new by restudying what they have learned, be inspired to explore the universe and the unknown, thus be motivated to be capable, ambitious and enterprising. Amusement implies combining learning with entertainment, students can be fascinated by the science and attracted to study hard in order to probe into the secrets of the world. Amusement is important not only in primary education and secondary education, it also plays an important role in higher education and vocational education. From the view of psychology, learning process is motivated from interests, ideal learning outcome relies largely on the active participation and great impetus of the students.

The authors consider scientiality, logic, heuristic and amusement the primary goal to organize a teaching process, and also the criterion to evaluate classroom teaching.

2. The Role of Textbooks

If the classroom is called the hall to disseminate knowledge, the textbook should be the Bible, the textbook is the blueprint for classroom instruction. Generally speaking, teaching process is initiated to implement the prescribed syllabus (at least in China) in which the course coverage is stated in detail, the textbook delivers disciplinary knowledge in the forms of written language, symbols and diagrams as well as analysis methods, learning methods according to the syllabus requirement. Thus the textbook should also be possessed of scientiality, logic, heuristic and amusement.

II The Importance of Instructional Design

1. Classroom Teaching Needs Instructional Design

It is a commonplace that different teachers giving the same course receive different instructional outcome although the syllabus is the same and they do diligently prepare their lectures, why? Different ways of instructional design! In light of the concrete student population, teaching content, and concrete goal, every responsible teacher have to make arduous efforts to prepare their lectures from lecturing sequence, ways of expression, examples, case studies, ... to media selection, blackboard arrangement, this is what instructional design is like! In educational technology, instructional design is a planning process and operational procedure in which teaching content is investigated and analysed, instructional policy and measures are formulated, instructional outcome is evaluated. Based on the analysis of teaching demand, instructional design is aimed at formulating the teaching steps, and is evaluated by feedback and final outcome.

2. The Authoring of Textbooks and Coursewares Needs More Instructional Design

Instructional design is the first step and also the most important step for all the teaching activities including classroom teaching, in-field practicing, and courseware/lessonware authoring. Textbooks are merely knowledge carrier in the forms of characters and diagrams, while coursewares possesses three features: i) they are knowledge carrier in the form of multimedia(such as characters, diagrams, pictures, animations, voice and music), ii) they are knowledge carrier with interactivity , iii) they are knowledge carrier with lots of knowledge nodes connected in a nonlinear structure. Therefore courseware features stronger expressivity, deeper impressivity and better applicability to individual study, thus, the newer and higher standard for scientiality, logic, heuristic and amusement should be satisfied, this makes good challenge to the courseware instructional designers. The instructional designers should learn from movie-directors in deliberating every plot(knowledge node), every artistry(instructional means), every line and prompt(classroom sentence)......, should keep in improving every details constantly and produce final scripts similar to what movie-directors have done.

3. Method for Courseware Instructional Design

Courseware instructional design is a process in which a specified discipline is combined with psychology, pedagogy and information technology together, also a process in which disciplinary experts collaborate and pool collective wisdom. From the point view of educational technology, teaching process is a system, the outcome of this system is the interactive result of multi-inputs such as teachers, students, instructive goal, teaching method, instructive media, evaluation means and so on. The general procedure for instructional design, as shown in the following diagram, consists of student analysis, goal definition, content specification, instructional strategy definition and evaluation. The whole process is cycled in order to seek gradual refinement.

Student analysis includes student population analysis and task analysis. Student analysis is to investigate student's psychological and physiological background such as age, sex, motivation, experiences, cognitive ability, learning style, learning ability, disciplinary knowledge and so on. Task analysis is to investigate the requirement of the course syllabus, and the discrepancy between the required and the student's existing status, so that the following steps can be taken.

Goal is a newer and higher level which should be attained after completing the specified period of study, it is the starting point for course instructional design and also the basis for courseware evaluation. Goal analysis is the fundamental method to define the constituents of teaching content and their interrelations. Generally, the goal is logically divided into subgoals according to the logical relations inside the teaching content, so that proper teaching steps and measures can be taken. Psychologist B.S.Bloom divided instructional goals into six kinds: knowledge, comprehension, application, analysis, synthesis, evaluation. A specific goal should be defined for each course, each lesson, each class, each courseware and each lessonware, the emphasis should be placed in description of the expected improvement and progress of knowledge, behavior and skill students have made after

completing the specified period of study. Instructional goal generally includes specific group of tutees, expected academic progress, the conditions needed to realize this goal and corresponding evaluation specifications.
Objective denotes the role the courseware should play in instruction (such as demonstrations, simulations, exercises and drills) and the expected teaching requirement. Only the purpose is made clear, can the teaching content be selected and organized accordingly in order to realize the set goal.

Instructional content and goal is complemented with each other, once the knowledge and skill requirement is set, the teaching content is set accordingly. In most cases, problem-solving ability is one of important goals, this requires that special attention be paid to the study of rules and that combination of learned rules, conceptions and efficient cognitive strategy be made.

Instructional strategy is the comprehensive planning of multi-factors in instructional activities (such as programs, forms and media) for the specific goal. Teachers should take the information selection, acquisition, organization and storage into full account, establish the interrelations between knowledge nodes according to the cognitive theory, seriate all the instructional content from the easy to the difficult, from the concrete to the abstract, and guide students to master the newer from what they already learned. The expressive means should be determined on the basis of the effectiveness of student encoding, memory and control strategy advantageous to the knowledge restoration.

Evaluation Instructional design includes formative evaluation and summative evaluation. Formative evaluation identifies the weak and strong points so that the designer can revise it, which is similar to the beta testing for the newly-developed software. A formative evaluation can go from several single user sessions to trials with small groups. The experiments include the mastery of the defined content, frequently-occurred errors, clearness of the content, student's interest and so on. There are some ways to receive feedbacks such as quiz, questionnaires, teachers' informal observations and so on. This evaluation provides feedback information and help re-analyse student requirement, re-adjust goal, content, strategy. Summative evaluation is done with medium-sized groups, usually 30 per group. The objective is to show where to make changes in future versions. In ideal sense, no evaluation is ever really final. The design process is not linear but iterative. As we go forward and gather more information, we cycle back to earlier stages to revise and refine. In China, summative evaluation is mostly done by an expert panel, scientiality, logic, heuristic and amusement are the major indices. Since a specific courseware should be oriented to some scope, applicability should be of great concern. It should be stressed that no evaluation is final, nor an instructional design is perfect.

Student requirement Analysis re-analyse

Goal Definition re-adjust

Content Specification re-adjust

Strategy Definition re-adjust

Evaluation

Satisfied? N

Y

End

III Issues in Courseware Instructional Design

1. Reasonable and Clear Goal Is Critical Usually the course syllabus is the goal for that course. When designing a courseware, thorough analysis of the general goal should be made first in order to find all the subgoals and specific requirement, teaching steps, knowledge nodes and expected skills or behavior, all these should be described in detail as they direct the instructional activities, and also form the basis of student motivation. The goal should be reasonable, practical, operational and easy to check. A well-defined goal must be explicitly described study outcome or behavior, and must include four elements: tutee, standard, condition and behavior as below:

Students	should be able to recite	all the poems learned in this lesson	with hundred percent accuracy.
Tutee	Behavior	Condition	Standard

2. The Courseware Instructional Design Should Be Faced to The Student's Cognitive Structure When designing courseware, special emphasis should be placed to the student's cognitive structure inside his/her brain, conditionalization, structuralization and strategicalization of the learned knowledge is required of the students. The conditionalization means to grasp the conditions to apply the learned knowledge in addition to have a good mastery of what they learned, structuralization means to systemize and restructure both the newly learned and the existing knowledge in order to form an efficient knowledge network, strategicalization means to reorganize and modify the learned rules in order to improve search efficiency and form strategic knowledge. The knowledge structure defined in the course syllabus is important, of course, but the more important and the more liable to be ignored is how to promote the development and optimization of the existing cognitive structure, is how to facilitate the formation of new cognitive structure of students. In this regard, coursewares have great potential and bright prospects.

3. Courseware Instructional Design Should Be Oriented to Student Intrinsic Motivation When designing a courseware, it is necessary to activate or maintain student intrinsic impetus, and try to cause cognitive dissonance occurred to students, so that curiosity could be activated. This is good to help students study and learn the new knowledge, finally results in the assimilation with the old cognitive structure. The above mentioned amusement does not mean to have students develop interests merely by simple external stimulation, and what is more, resorts to the intrinsic cognitive dissonance to strengthen student motivation and their thirst for knowledge.

4. Classification of Knowledge and Related Instructional Strategy In order that coursewares are applicable to student's learning practice, knowledge can be divided into two categories: memory-oriented and comprehension-oriented. Memory-oriented knowledge denotes to definitions, graphs and data which are difficult to relate to student existing knowledge structure, thus intensive remembering is necessary. For this category of knowledge, behaviorist learning theory and method should be resorted, large quantity of exercises and drills should be designed to reinforce the stimulation and impress the students. Comprehension-oriented knowledge stands for those new knowledge that can be inferred or derived from what students have mastered. For this category of knowledge, cognitive learning theory should be resorted, the stress should be laid on teaching students how to infer or how to derive from the learned knowledge, and on mastering the knowledge by comprehension first. Thus, different knowledge should be dealt with in different way of instruction. Memory-oriented knowledge can be stimulated by music, voices, graphs, repeated drills, exercises or promoted by association, analogy in order to be stricken into memory impressively, while comprehension-oriented knowledge can be promoted by inference, derivation and reasoning.

5. Conception and Its Assimilation According to D.P.Ausubel's definition, concept is symbol-represented objects, events, scenes or properties that share common attributes. To learn concepts is to master their common characteristics of a certain category of objects. The psychological process for the conceptional formation includes identification, abstraction, division, hypothesis proposition and examination, summary. Concepts that are formed directly in observation, experiences and analysis are called primary concepts, while those formed indirectly from definitions on the basis of primary concepts are called secondary concepts. In regard to children, as limited by their existing knowledge, they can only learn primary concepts from concrete practical experiences and then by induction of their common attributes. For teenagers and adults, as enriched by their growing knowledge, they can learn secondary concepts from their existing knowledge in cognitive structure by definition and summary of the new concepts, this is called conceptional assimilation. It is evident that with students growing up everyday, primary concepts become more and more, conceptional assimilation plays a dominant and principal part in expanding knowledge accumulation. Of course, in instructional design, conceptional assimilation should be brought into full play to guide student cognitive activities actively and correctly.

The 21st century is tiptoeing to us quietly, and knowledge economy is waving for us. Development of life-long study and improvement of teaching quality remain high on our agenda. No matter whatever teaching role is played (Classroom instruction, practical teaching, textbook authoring or courseware authoring), there are great demands for instructional design, great attention should be paid to instructional design. In the authors' opinion, there is plenty of room in instructional design to improve teaching efficiency and teaching effects, it is imperative and necessary to organize and pursue the methodology research and case study in instructional design.

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INTERNATIONAL

Revamped Computer Aided Instructional Systems in Shanghai Key High School

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Abstract: Challenged by a strong need of computer integration in all disciplines of learning and encouraged by successful educational computing experiences in many technologically advanced countries, the key high schools in Shanghai are revamping their computer aided instructional systems. The CAI system in Qibao High School is one of these model systems. This paper introduces the five main features of the system that include Computer Networking, Closed Circuit, Video Conferencing, Broadcasting and Multimedia Teaching Theaters, and analyzes their related issues.

Introduction

Challenged by a new paradigm of teaching and learning in an information age and inspired by successful computer integration experiences in American education (Interactive Educational System Design, 1996) and other parts of the world, the key high schools in Shanghai are revamping their computer aided instructional systems. The Associate Director of Shanghai Education Commission announced last summer that by the year of 2000, twenty information centers would be built in its twenty districts/counties, 200 school local area networks would be completed, and at least two third of the elementary and secondary school students would have access to the Internet (Zhang, 1998). Considering her limited technology resources and an educational budget that was less than 3 % of GNP (Zhou, 1998), Carrying out a strategic plan like this in China was by no means a moderate endeavor.

To implement these strategic goals, the key high schools in Shanghai are playing a leading role in revamping their existing computer aided instructional equipment in their schools. Among their efforts and achievements was the newly completed computer aided instructional system at Qibao High School. It has been recommended as one of the model CAI systems and will be installed in more high schools in Shanghai. This paper introduces the five main features of the system and analyzes its related issues.

Background of Qibao High School

Qibao High School is located in a rapidly developing area of Minhang District in the southwest of Shanghai. It was established in 1947 and became a key high school in 1961. The 1997-1998 academic year saw a total student enrollment of 2,300, of which 1,680 were boarding students. 158 teachers and staff members were employed to facilitate 54 classes. Before 1997, computers were only used to teach content knowledge and skills. To meet the increasing demand of integrating information technology in all disciplines, the school faculty and administrators decided to revamp their lab oriented facilities and design a comprehensive CAI system. The new system was contracted to the computer engineers of Jiaotong University, which was one of the prestigious universities in China. The installation of the new system was completed in the fall of 1997. When the school moved into its 200 million Yuan (about 24 million dollars) new school complex last year, the CAI system was part of the new school facilities.

The Major Features of the CAI System

The new CAI system was developed by the computer engineers of the Center of Educational Technology in Jiaotong University in collaboration with computer staff of Qibao High School. Those engineers had been following the development of educational technology very closely in the last decade and had developed a number of software programs to facilitate teaching and learning in China. The CAI system developed by the Center

included five major components including Computer Networking, Closed Circuit Teaching System, Video Conferencing, Broadcasting System and Multimedia Teaching Theaters. Figure 1 illustrates the five major components of the system.

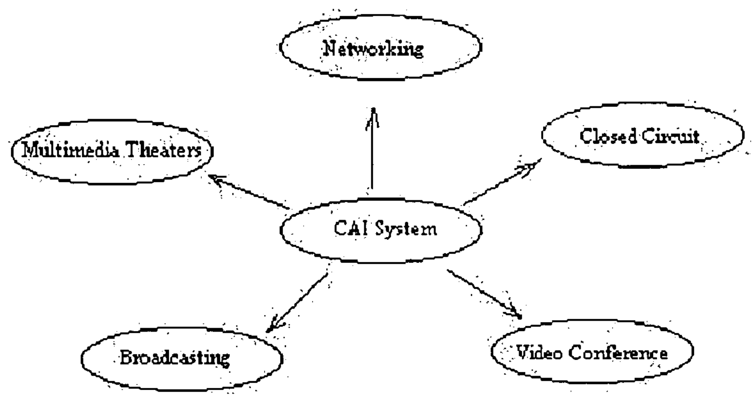

Figure 1. Five Components of the CAI Instructional System in Qibao High School

The Computer Networking

Having worked with all major CAI teaching modes that included the Mainframe/Terminal, Client /Server and Browser/Server, the computer engineers of Jiaotong University adopted the latest Browser/Server structure for the CAI system of Qibao High School. Because the Chinese version of the Window NT shared the same platform with the Chinese version of Window 95, it was easier to use Windows NT as the network operating system compared with the Unix System. Two HP LD Pro Servers were used to divide the system into Teaching and Service areas. Each server supported a networking area to reduce cross interference. A Cisco IOS system software and the Ethernet topology were applied to the system. The data transfer speed for local area network was 10m and it sped up to 100m when connecting other networks. The school was connected with the Education Bureau of Shanghai through a Hayes Modem. HTTP, FTP , Gopher and Telnet services were provided on the network to reach other internet sites. Figure 2 illustrates the structure of the network.

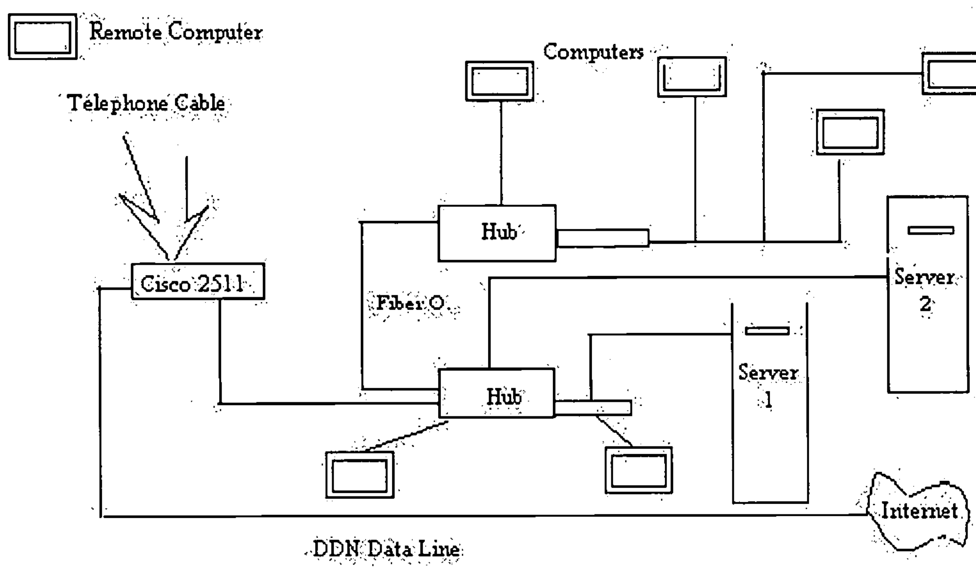

Figure 2. Network Structure of Qibao CAI System

(Adapted from *Manual of CAI System of Qibao High School*, 1998)

Data from the remote computers and other sources were fed through the Cisco 2511 Router and a modem to the servers and relayed to other computers. Fiberoptics were used to link two hubs that connected multiple student computers. The same structure also accommodated data interactions within LAN and between networks. To speed up connection, a DDN Line was rented from Shanghai ISP to connect the School to the China-Net. Apart from the two upgraded HP LP Pro Servers (one changed into a FreeBSD 2.2.5 Operating System), other major equipment included Cisco2511 Routers, a 64K DDN line, a Hayes 33.6X16 CenturyII modem and a DTU2701 New Bridge.

In order to make the best use of limited equipment, the computer engineers of the system developed a unique HK-CI Switch to connect telephone, closed circuits and computer systems. Through this delightful device the telephone receivers in the Control and other classrooms could be used as a mouse, and the connected television screen would be turned into a monitor. The advantage of this system was to let classroom teachers remote control the Resource Room. Hence more teachers would be able to share one set of hard ware and limited software programs in the Resource Room. Following is a picture of the phone receiver-turned-mouse that has numbers and directions marked on it to remote-control the computer and software usage:

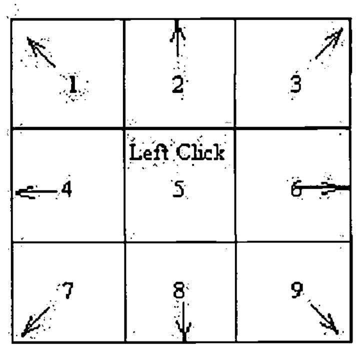

Figure 3. A Phone Receiver-Turned-Mouse

(Adapted from *Manual of CAI System of Qibao High School*, 1998)

2. Closed Circuit System

The Closed Circuit system consisted of three parts, namely the TV Receiving, Satellite Receiving and Broadcasting. It was able to receive 7 regular TV channels and 4 satellite relayed programs. The Broadcasting part was also called "remote play." It was subdivided into a Broadcast Room and 87 teaching points, which included 53 classrooms, 3 teaching theaters, 1 revolving conference hall and 24 labs. All 87 places could receive and remote-control the resource selection and playing. There were 6 HP5 Video Cameras, 2 HD82 Video Cameras, 1 Laser Player and a large number of Compact, Video, and Laser discs in the Broadcast room. All sounds and images were edited here before they were sent through the Closed Circuit system to other classrooms.

3. Video Conferencing

Video Conferencing system consisted of Studio Control, Monitoring and Video Recording Points (not used yet). Recorded signals were sent back through 8 channels to 8 monitors. The main control station was placed in the Main Control Room, and the second control station was located in the Principal's Office, so he/she could supervise various activities in all the recording points when necessary. There were a total of 102 routes, 158 recording points, covering all essential areas including teaching buildings, labs, Library, Cafeteria, Art Gallery, Gym, and sports fields. Major equipment included a Pentium MMX computer, a HN-4300 Video Switch, a HN--4300 Audio Switch, 2 Panasonic NV-HD 82 Video Cameras, and four 14K--M1 Sharp Monitors.

4. Broadcast System

The upgraded broadcasting system was based on the existing school equipment, which was similar to the standard facilities in most high schools in Shanghai. It consisted of various sound sources, amplifiers, a multiplexer, cable routing and a number of speakers. Sounds from TV, Radio, CDs, microphones and other sources were mixed and edited here and sent to all classrooms. It could also be used as part of the Closed Circuit teaching system. Major equipment included FJD250 and FJD 300 Amplifiers, Feile TI 802 Multiplexer, AKAI CD Players and multiple YX3 Speakers.

5. Multimedia Theaters

The Multimedia Theaters were characterized by Visual, Audio and Multimedia capabilities. The visual was accomplished by mixing signals of the videos, laser disks, computers and 3 dimensional objects and projecting them to a screen. The audio part mixed the sounds from all sources, amplified them and then sent them to 7 loud speakers. The multimedia part was facilitated by a multimedia computer. The largest Multimedia Theater could

house 600 people. The other two were able to facilitate 300 and 200 respectively. All three theaters were capable of entertaining a variety of activities, such as speakers, films and conferences.

Discussions

The CAI system in Qibao High School is one of the first comprehensive systems in Shanghai high schools to address the pressing need of integrating information technology in teaching. It has its distinguished advantages and disadvantages. First, It adopted a model that enabled teachers and administrators to share limited resources, such as hardware and software programs. It was essential to a developing country like China. Second, its centralized control mode rendered a relatively easier operation for teachers and administrators. It was a more comprehensive system than the CSC Principal's Management System (Bao, 1995) The latter was mainly an administrative system, which was also upgraded recently. Third, it provided many creative and home made gadgets, such as the phone receiver-turned-mouse used as a remote control devise for integrating TV and computers. Fourth, It was built on the existing facilities of the closed circuit system. Many schools in Shanghai had been equipped with the closed circuit system. These gadgets and other home developed software used in the Library and reading rooms will substantially speed up the computer integration in other schools.

Nevertheless, this system also has its noted controversial characteristics. The centralized control mode is a culturally constructed system. It may fit the centralized leadership style of Chinese school administration, but it will run into major clashes with American school philosophies and practices, due to their resentment to "Big Brother Watching" phenomenon. For example, the second control station of the video recording was installed in the Principal's office, which would be quite acceptable in Chinese systems, but would become a hot dispute in administration of American schools.

During the interviews with the Qibao School administrators, the researcher noticed philosophical and practical differences in computer applications compared with that in American schools . For example, Internet access was regarded indispensable for the high school systems in America. Schools were given green lights to be connected in all states. Integrating Internet resources in teaching and learning had become a way of life for teachers. The researcher was surprised to find that despite of availability of internet connection sockets in all the classrooms, internet use was not strongly encouraged. As a matter of fact, when the budget was a little short of expectations, computers in the classroom to receive the Internet information were the first to be cut, though Internet access was still available in the Library and another reading room. The rationale hinted was that Internet access was less correlated to the university entrance examination scores of students. For key schools like Qibao, university entrance ratio was critically important. Other possible reasons of neglecting Internet resources included a. Internet was a new phenomenon, and it took time for teachers and administrators to get to know it better, b. Slow access to the needed databases due to less advanced equipment, and c. Some censorship to the internet connections in China also discouraged some people.

Finally, it was the old dispute of educational equity issue that was very real in the computer applications in Shanghai. There was a big discrepancy between the financial conditions of Key and Non-Key high schools. It would take a long time before all schools could afford to install facilities like this. Those schools, however, probably need these equipment even more.

Because this system was new in Shanghai, there was no research yet to evaluate its effects compared with non CAI supported teaching methods, some research was being conducted by individual teachers in the classroom. One thing that needed immediate attention was the faculty training. Without adequate training of the teaching faculty, it would be very difficult to use the system to its full potential. The administrators of Qibao High School were coordinating with technology staff of East China Normal University to address this issue. The project that the researcher was working on last summer that brought her to Qibao High School was exactly one of such collaborations.

To sum up, The CAI system of Qibao High School symbolizes a new stage of computer aided instruction in Shanghai. Despite all the controversial characteristics of the system, this is a very creative and useful CAI system for Qibao High School students. The researcher wants to point out that what Shanghai key high schools are going is only the beginning of a massive implementation of computer facilitated teaching and learning in China. She expects to learn more from this and other CAI systems in Shanghai in the next few years.

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Why Should IT in Teacher Education have a Global Dimension?

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Abstract: The Society of IT in Teacher Education aims to promote the use of IT in teacher education. SITE's conferences, journal and associated activities attest to the value of this for realising the quality of the three dimensions of higher education: teaching, research and administration. A focus on the education for 2040 clarifies the mind. This is when today's young teachers will be ending their teaching career. By 2040 it is reasonable to expect that global issues relating to the environment and to cultural diversity must be a major focus in education. It is relevant to help today's students prepare to use ICT to bring pupils' respect closer for apparently 'distant' lands and cultures. The paper draws upon extensive research and development across Europe and collaboration with colleagues in the far East, Australasia and North America. It also asks: what can SITE do to promote global education?

Introduction

Teacher education aims to prepare beginning teachers for a career, one that may last for over 30 years. Already too much has to be squeezed into the programmes of study and practice and yet this paper dares to suggest the addition of another dimension.

The introduction and infusion of information and communications technology into programmes of study in universities and on placement in schools has raised major challenges that include substantial organisational and professional development (President's Panel on Educational Technology, 1997; Veen et al 1998). There is often the implicit hope that Information and Communications Technology (ICT) will enable teacher education to more effective use of government funding, particularly through increased partnerships, including those with commercial services.

In the UK, the Teacher Training Agency has suggested a redesign of programmes is expected to ensure that they can cover the new National Curriculum for ICT in initial teacher training. This is unlikely given the few months allocated for implementation, probably due to the need to precede the 'remedial' training in ICT for practising teachers to be funded from the UK Lottery. Elsewhere in Europe there are also attempts to redesign teacher education. For example, Amsterdam Hogeschule is currently implementing a revolutionary approach of problem based learning as means to research and develop radical new educational reforms in The Netherlands (Dietze & Wielenga et al, submitted). The strategy adopted starts with a problem based approach to professional and institutional development itself that is interlaced with ICT information and profiling system. Colleagues in Amsterdam are seeking real problems for student teachers to work on during their course within and beyond the educational institutions and they are collecting resources and developing guidance to facilitate them in directing their own studies through a process of professional development that is itself problem based.

In Victoria, Australia, the revolution is starting in a cluster of "Schools of the future". In the USA we can also observe a range of initiatives including both school focused projects and exciting professional partnerships between schools and universities. For example the Curry School's programme strategically ensures that student teachers can learn about technology integration while assisting teachers who themselves are exploring new ways of using new technology and Iowa State's 'reciprocal mentoring' approach that SITE's incoming president demonstrated and described in SITE'98 (Thompson et al, 1998).

A common theme through these innovations is the deployment of ICT to enhance collaboration and, with the student taking more responsibility for their own professional development, collaboration across organisations and towards a shared complementary goals. However, I suggest that this collaborative approach needs also to become an explicit part of teacher education institutional goals, such that students and their mentors learn to collaborate across cultures as teachers and institutions develop partnerships that include nurturing of a diversity of cultures and their languages.

This paper argues that there are three reasons to incorporate a global dimension in teacher education: the context for education is becoming global; ICT is being used to increase access to education on a global scale; and taking a global view can enhance teacher education through the provision of stimulating rich contexts for critical reflection. Let us now take these arguments in more detail before illustrating ways in which a global dimension could be incorporated in programmes of teacher education.

Globalisation

As teacher education moves towards more complex organisational arrangements of collaboration and competition at different levels, we are following similar trends in commerce and industry pushed and pulled by Globalisation. Dauphainais & Price (1998) edited together the views of prominent chief executives under six themes, with the first as Globalisation. The others were radical change, leadership, culture, innovation and customer service. The five later themes are already challenges in teacher education and this paper suggests that we must also face up to our role in the globalising of our cultures as workers across the world struggle for job retention and standard of living enhancements made possible through the *"uncoupling of the corporation from the nation state. Rapid free flows of technology, capital, and employment contribute to this 'global village' effect." (p21)*

However I am not suggesting that the need for a global dimension arises from a widening of our markets, at least not yet. As yet we do not see an economic case such as those pursued by multinational companies and their agents (Davis et al, in preparation). As part of our large European project 'Telematics for Teacher Training' we have investigated the feasibility of providing services for ICT in teacher education and we find that, although the 'market' is starting to emerge in countries such as the UK with initiatives such as Lottery funded teacher training, the majority of teacher training is funded though grants to institutions and is thus not available to others. However, Robin Mason (1998) does provide case studies of the implementation of 'globalised' courses in higher education in other disciplines.

Instead, the first case for a global dimension comes in part in connection with the multinational organisations' activities. Our societies are becoming global and education must adapt to this new context, including improving multicultural education. A second reason was noted by Morrison (1995). Globalisation of economic activities is forcing all nations to establish wider access to learning using communications technologies to create an *"'educational options map' involving the cost, scale, quality, relevance, portability, futurity, flexibility of an access to education"*

Finally, this paper suggests that a global dimension in teacher education has the potential to enhance quality. Opportunities for critical reflection are improved when students and staff are engaged directly in comparison and contrast of approaches and cultures.

Reflection

The value of a global dimension to teacher education can be underpinned by theories of reflection. There is widespread acceptance that reflection is a crucial element in the professional growth of teachers (Calderhead & Gates, 1993). Hatton & Smith (1995) draw out four forms of reflection in a hierarchy: descriptive writing; descriptive reflection; dialogic reflection; and critical reflection. In the highest level, critical reflection, student teachers accounts of teaching are referenced to a broader historical, social and/or political contexts. It is this most complex form of reflection that may be seen to benefit from a global dimension. A student is likely to find meaningful and rich contexts and problems with which to engage that challenge their assumptions of educational practice. As described later teacher educators are able to deploy ICT to provide rich cases and contexts for reflection across

pedagogies, disciplines and cultures. These are linked to a constructivist approach. However as John McShea in his PhD thesis (in press) notes that this requires careful planning:

> In telematic [ICT] environments, a particular constructivist stance establishes how learning might be effectively supported. This has implications for the pedagogical structures which needs to be supported and thus what may need to be designed into a system. The educational framework of that design supports certain types of interaction. ... The nature and support for guided participation through Lave and Wenger's (1991) views of legitimate peripheral participation also have implications for the design of communication systems e.g. who is in control; for how long, and how roles are to be managed. (p23 in final draft)

Principles for technology in teacher education

Having established the value of a global dimension to teacher education, I would like to take an opportunity to reflect on how such a dimension can be incorporated in teacher education. During 1998 the T3 project developed a core curriculum for Telematics in teacher training which is described in a parallel paper in this conference (Davis & Tearle 1999). In attempting to negotiate this curriculum across more than seven European countries and informed by the literature, we evolved a holistic approach in which the three dimensions (collaboration & networking; pedagogy; and technology) are bound together by lifelong learning, globalisation and management of change. At the same time colleagues in the USA, led by Jerry Willis were drafting principles of ICT, or technology, in teacher education in response to a call from Washington DC. The three principles are phrased for use throughout the world:

1. Technology should be infused into the entire teacher education programme.
2. Technology should be introduced in context.
3. Students should experience innovative technology-supported learning environments in their teacher education programmes.

These are followed by six proposed actions *to which I suggest the addition of a seventh*:

1. Identify and make public positive models of technology-infused teacher education programmes.
2. Encourage and support collaboration of teacher education programmes with model technology-rich K-12 schools that can serve as authentic environments for teacher education.
3. Establish two to three national centres for technology and teacher education
4. Support innovative models of faculty development
5. Support models of technology infusion
6. Fund the development of promising teacher education materials
7. *Encourage the incorporation of a global dimension into programmes and organisations*

Students connected through communications technology should be supported and encouraged to critically reflect upon global issues. The significant professional and organisational development of colleges and K-12 schools stimulated through this action has the potential to support profound changes in multicultural dimension of teacher education and our societies.

Resources for a global dimension

A global dimension includes the development of multicultural understanding. Kathleen Sernak and Carol Wolfe, in their recent paper reporting on the use of Email for this purpose, provide a review of the literature noting that *'theorists understand multicultural education as transformative, calling for a re-evaluation of ingrained values, beliefs and assumptions that influence educational policy'.* The course supported Email connections between pairs of students in different cultures while they studied multicultural education: one in at a societal level (macro) and the other taking a school perspective (micro) to stimulating intellectual growth and build a community. They report that pedagogy assisted students' construction of knowledge:

> Becoming a "critical multiculturalist", therefore, links the theory of liberatory pedagogy with the practice of constructing knowledge through students' experience, self-awareness, and self concept to alter the cognitive filter in order to construct a different reality. (p306)

Other approaches have started with the creation of resources to stimulate and to structure reflective practice. For example Bob McNergney has led the creation of a large variety of cases of educational challenges set in many different cultures and countries and stimulated the approach through competition. He continues to explore the added value of communications technology and multimedia in the process.

In Europe we have also used Email, although not in such great depths Sernak and Wolf. More recently the European Commission has supported the development of ICT to collaboratively research and develop courses and resources for teacher training. The evaluation of all three major EC projects points to the need for overt attention to a dimension which enhances understanding of other perspectives, cultures and languages (Davis and Taylor, 1999). This work also provide significant resources for use in teacher education. For example the cross curricular course for teaching environmental education on-line drew upon the EuroTurtle web site and the related expertise.

Most recently the Exeter Telematics Centre has been developing a *ICT Educational Research Centre* (ERC) on the Internet in the UK's *Virtual Teacher Centre*. We aim to make research into ICT in education accessible to classroom teachers and to encourage them to join in with professional discussions. As we develop this concept we now acknowledge that it will be important to build in a global dimension, because without it users of the ERC will be less likely to understand the discourse as it is extended to research from other countries. We hope that SITE members will come to the centre and join in the developing communities there. The embryonic site is adjacent to SITE's international web site hosted in Exeter at: http://telematics.ex.ac.uk/ERC/

Conclusion

This paper has discussed the need for a global dimension in teacher education and provided some guidance to early approaches and resources. As we move into the millennium teacher educators will need to tackle this challenge in a coherent and effective manner. This paper invites your contribution and your assistance in developing our common discourse and increasing respect for cultures and pedagogies in all parts of the world.

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The Research and Development of an International Core Curriculum for Information and Communications Technology in Teacher Training

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Abstract: This paper outlines progress of the EC supported Telematics for Teacher Training (T3) project in the development and dissemination of a European Core Curriculum for Information and Communications Technology in Teacher Training. National and European governments have recognised the importance of training teachers in the use of information and communication technologies, hence there is a recognised need for such a curriculum across Europe. The paper outlines the aim of the T3 project which is to work with teacher trainers across Europe to support them using ICT in order to enhance their own professional development and the learning of their student teachers. The paper finishes by describing the work in to develop a European core curriculum in teacher training. The final product of the Core Curriculum policy document is presented.

The Need

There is widespread acknowledgement that telematics or Information and Communication Technologies (ICT) can be used to enhance learning and teaching. Many countries around the world are taking action to ensure that their educational systems are updated to permit equality of access and to ensure that the key ICT skills are developed in schools and other educational institutions. The central tenet of the European Information Technology policy is to provide equal access for all, irrespective of where they live in the Community, to the highest possible standard and widest possible range of education and training. It has become abundantly clear that the training of teachers in ICT skills and appropriate pedagogical approaches is essential. "Preparing teachers is perceived as the main critical success factor in deploying ICT in education" (Weets, 1997). Individual countries also feel this as an urgent need. For example the UK Government published its consultation paper 'Connecting the Learning Society' (DfEE, 1997). This outlined UK Government plans to create a National Grid for Learning. The grid will allow schools to link to each other and also to all other learning institutions such as libraries, universities and museums. It will also build content and processes that will make these networks come alive. The document states that a vital strategy within the Grid will be the development of the skills of teachers and librarians. In the United States of America the Panel on Educational Technology has submitted a report of its recommendations to the Government (Shaw, 1997). Two are of particular significance to the work described in this paper: 'Give special attention to professional development' and 'Initiate a major program of experimental research'.

The European Commission's (EC) Framework IV research programme (European Commission, 1994) also noted the need to identify and disseminate good practice and to establish a core curriculum for telematics in teacher training. It recognised a need to establish a shared vision of a curriculum for teachers undergoing training.

The examples as quoted above show the recognised need for a Core Curriculum document, and it is accepted that such a document would be of value both to policy makers and to those with responsibilities for course planning. However, there have been few attempts to undertake this task in the USA, the UK, or other European countries. Four examples of work in this field are reviewed later in this paper.

Three projects were part funded within the EC Telematics Applications Programme to develop ICT in teacher training. This paper draws on the work of the project with the same title 'Telematics for Teacher Training' (T3) which contains a work package specifically to develop and disseminate a European core

curriculum for ICT in teacher training. This work package draws on the outcomes of a needs analysis undertaken within T3 in 1996. This identified the valuable roles that multimedia telecommunications can play in European Teacher Education (Davis, 1997).

The T3 Project

The T3 project started in 1996 and continued until the end of 1998. It is persuading teachers, via teacher trainers, to adopt ICT in order to enhance their own and their students' learning. In this way, it is planned that European teachers will equip tomorrow's employees and customers with the competence to use tele-training and ICT within their work.

The T3 project is playing a key role in the process of extending understanding and awareness of the benefits of global communications. The project is creating courses, resources and developing professional networking for the training of teacher trainers. These teacher trainers then train teachers who themselves teach young people. So there is a multiplier effect; the project title would suggest a cubing effect T^3, though mathematically this is a gross underestimate. Probably the most important long-term impact of the T3 project is this 'multiplier effect'.

Specifically, the goal of T3 is to encourage teachers to adopt use of ICT as part of their daily work. Different work packages within the project focus on the curriculum areas of mathematics, languages, science and technology. In addition to this there is one which focuses on teacher educators, one for primary teachers and one for library staff. Partners are located in eight different European countries. The resources and courses are based on the use of case studies and are developed to be exemplars of good practice.

This distillation and modelling of best practice in the use of ICT for teacher education has been undertaken across primary and secondary education. Best practice using the Internet and video conferencing over ISDN is being infused into both 'face to face' and distance learning courses with teacher trainers. By the end of 1998 accredited modules in effective use of ICT for teaching and learning have been delivered 'at a distance' through use of communications technologies.

Over 5,000 students and practising teachers were supported in their adoption of ICT for their studies and its use in schools. This has established a community for learning and professional development. A course has also been developed for library staff working with teachers. Through a linked network of Web servers, the T3Centrum provides resources, information and opportunities for team teaching and collaborative development across Europe at http://telematics.ex.ac.uk/T3

A Core Curriculum for ICT?

The core curriculum for ICT in teacher training is envisioned as a policy document for use at many levels. It will concentrate on the overlap between Information Technology and Communication Technologies, such as use of the WWW, Email, computer conferencing, video conferencing etc., rather than taking the whole range of IT applications in education. It is made available to the EC and national governments to inform strategic thinking. Institutions including schools and teacher training organisations will be able to use it to inform cross-curricular planning and the organisation of resources. Teachers and their associations will be able to plan their members access to both ICT itself, key skills for ICT and ways in which to deploy it in education and for their own professional development. Assessment and accreditation bodies will also be encouraged to incorporate ICT into their frameworks. The creation of a core curriculum for teacher training could be a significant contribution to improved communication about the needs of teachers and of teacher education across Europe and more widely.

This vision of an appropriate version for a core curriculum has been informed by previous attempts to create similar policy documents for use by teachers and policy makers. We will now briefly review them.

In 1990 in the USA the International Society for Technology in Education (ISTE) drew up a policy document (Handler & Strudler, 1997) to describe the competencies and contexts that the USA national association felt reflected the professional needs of teachers in relation to ICT. This was a lengthy document with many statements and referenced the guidelines for the United States National Council for the Accreditation of Teachers.

The ISTE document appears to have been relatively under used as shown by the report USA Congress Office of Technology (Fulton, 1996) into IT in teacher education, which identified significant and urgent requirements to develop ICT teacher education in the USA.

In 1992 three bodies came together in the UK to create a framework for competencies in IT in initial teacher education: The Association for IT in Teacher Education (ITTE), the National Association of Advisers in Computer Education (NAACE) and The National Council of Educational Technology (NCET). The result was a holistic framework (ITTE, NAACE & NCET, 1992) which acknowledged that ICT skills could not be practised independently of their context, (see *Figure 1*). The document was widely disseminated in the UK. Its size, a folded sheet of A3, i.e. only 4 sides of A4 paper and its layout, made it easy to assimilate. It permitted those responsible for ICT to disseminate it within their institutions and to encourage a debate. It pr

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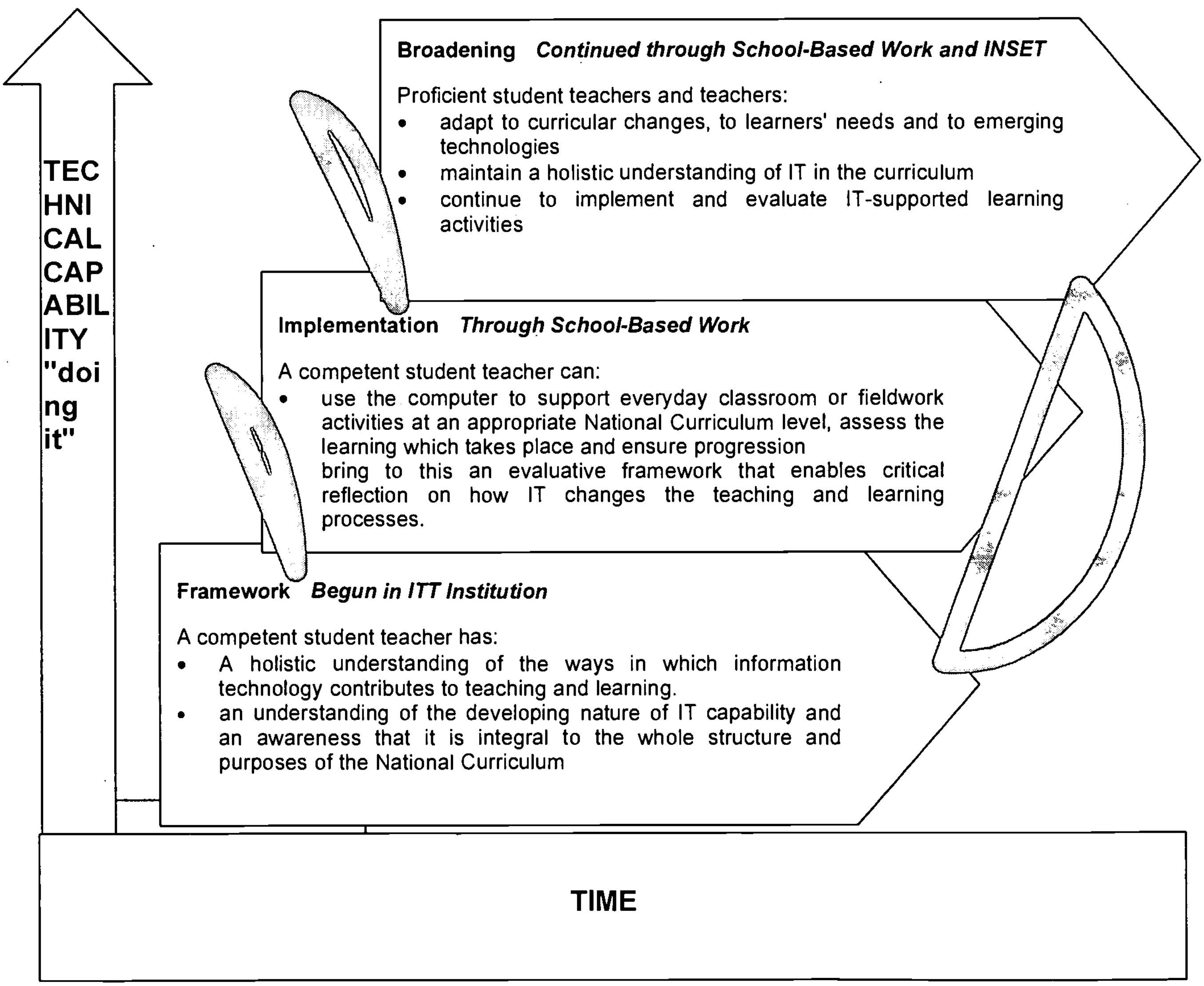

Figure 1: Competencies in Information Technology in Initial Teacher Education (From ITTE NAACE & NCET, 1992)

Since then the framework has been further developed by NCET (National Council for Educational Technology, 1995) into a document for practising teachers which provides both the structure of a curriculum and strategies for ways in which it can be developed by individuals and schools. It remained the same length however, and was also widely disseminated and used. It is now in need of updating, particularly in relation to the recent developments of communications technologies and wider access to ICT in schools and for professional development.

During the autumn of 1997 a new approach was adopted by the UK Teacher Training Agency in the form of an Initial Teacher Training National Curriculum: The use of Information and Communications Technology in subject teaching (Teacher Training Agency, 1998). This document is detailed and lengthy and provides statements of competence for student teachers in the context of the subject and age phase for which the student is training to teach. It has two main sections entitled: 'Effective teaching and assessment methods' and 'Trainees knowledge and understanding of, and competence in, information and communications technology'. For example there is a requirement (17b) that trainees must demonstrate how reference sources such as the World Wide Web sites on the Internet are relevant to the specialist subject and phase for which they are training. This included how to search these sources for reference material and how to incorporate their use into teaching. Another statement stipulated that trainees must appreciate how ICT can be used to gain access to expertise outside the classroom, the school and even the local community through communications with expert (14b iv).

There are a number of other relevant documents we have studied, including The European Computer Driving Licence (ECDL). This is a syllabus designed to be of relevance to the whole community, not specifically teachers or those in education. It covers the key concepts of computing, its practical applications and their use in the workplace and society in general. This document was of interest because of its cross European nature. It differs from the one proposed in this paper in a number of ways, in particular the fact that the target audience of the proposed Core Curriculum is teachers, and therefore the focus on applications of communications technologies in the context of teaching. Also the Core Curriculum is, as its name suggests, is to be a curriculum, rather than a syllabus.

Developing a European Core Curriculum for ICT in Teacher Training

In order to develop a Core Curriculum for ICT in Teacher Training for Europe, we have drawn together collective expertise from within and outside the T3 project. The process has three main stages:

1. Information gathering (on-line questionnaire)
2. Workshop in May 1998
3. Validation and further refinement

A draft of a European core curriculum for ICT in teacher training was produced. It was made available on the WWW with a review of relevant literature, to inform the debate and an on-line questionnaire to encourage a wide range of people from across Europe to collaborate in the process. The core curriculum materials on the WWW permit links to be made to other on-line materials including those within the T3Centrum (the WWW site of the T3 project) itself. For example, the University of Oulu in Finland has led the creation of flexible learning materials which introduces ICT to teachers. These can be used as a reference source for those wishing to uncover detailed technical knowledge. The project's T3Centrum Web Site also contains many other useful items, including teaching resources, the structure of which implies their skills and contexts for deployment.

In May, these materials were transformed into briefing documents for an international workshop in Portugal, which included invited European policy makers, commercial organisations, experts and others involved in the delivery of teacher training with ICT. This workshop resulted in a new version for wider European consultation, first on-line in the public area of the T3Centrum and then presented at the Teleteaching conference sponsored by the International Federation of Information Processing in September 1998. The final version is now made available to teacher educators, policy makers and teachers across Europe.

The T3 Core Curriculum - Core Curriculum Framework for Telematics for Teacher Training

Core Curriculum's Purpose

This framework has been designed to assist policy-makers, course developers, teacher trainers and other professionals who are considering the use of ICT in teacher training. It is embedded into national and local infrastructure, culture and context, providing a framework upon which detailed curricula can be built. It also provides a durable framework with which these curricula can be kept up to date as new developments are forged in ICT and education. The production of a core Curriculum for Telematics for Teacher Training was an objective within the EU Framework IV research agenda.

The holistic framework is shown in Figure 2. Its three themes of Networking eight collaborative considerations, pedagogical considerations, and technological considerations are bound together with the management of change, globalisation. The three themes are also described in more detail in the statements below:

Pedagogical Considerations:

- an understanding of the opportunities of the uses of ICT for learning and teaching in the curriculum context;
- an understanding of the implications of the uses of ICT for learning and teaching in the curriculum context;
- the planning and implementation of learning and teaching in open and flexible learning environments; the management of learning and teaching in open and flexible learning environments;
- the evaluation of learning and teaching in open and flexible learning environments.

Networking & Collaboration Considerations:

- a critical understanding of the added value of learning networks and collaboration within and between countries and communities;
- an ability to participate effectively in open and flexible learning environments as a learner;
- an ability to participate effectively in open and flexible learning environments as a tutor;
- an ability to create learning networks that bring added value to the professional development of teachers;
- widening access and providing learning opportunities to all members of learning communities, including those with special needs;
- a willingness to contribute to the global learning society, lifelong learning and the local context.

Technical Considerations:

- an ability to use and select from a range of ICT resources as appropriate to enhance personal and professional effectiveness;
- a willingness to update skills and knowledge in the light of new developments to operate in open and flexible learning environments.

The T3 Core Curriculum is illustrated within the T3 showcase at: http://telematics.ex.ac.uk/T3/

Conclusions

This European core curriculum for ICT in teacher training has been developed by expert practitioners from over 8 European countries and disseminated to policy makers, teacher trainers and commercial organisations involved in education of training. It provides a valuable framework for moving towards the development of an 'Information society' across Europe. It is recognised that the document, when used in parallel with its supporting reference documents, will also highlight the size of the task ahead. Despite the multiplier effect referred to earlier, this should not be underestimated, and the T3 project team hope to be part of the task force to work on this and implement a core curriculum for ICT in teacher training across Europe. We look towards the Society of IT in Teacher Education to explore the wider value of this framework for other continents. Comments and suggestions are invited.

Acknowledgements

The T3 core curriculum has been developed in close collaboration with many colleagues. We would particularly mention Wim Veen and Dominic Prosser. DG XIII_C of the European Commission under the auspices of the Telematics Applications Programme has supported the production of this paper.

We would like to thank ITTE, NAACE and NCET (now known as the British Educational Communications and Technology Agency, BECTa), for the use of *Figure 1* and Marion Handler for her assistance in researching the ISTE Foundation Standards.

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Patterns of Change and Innovation in Pre-service Education

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Abstract Concerns about the poorly developed use of Information and Communication Technology (ICT) in UK schools resulted in the Labour Government deciding to pledge its commitment to provide further funding for the development of ICT in schools together with targeted funds for in-service teacher training and a National Curriculum for ICT in pre-service teacher training in subject teaching. This paper reports on the continuing changes taking place in the statutory standards for achieving Qualified Teacher Status (QTS) in the UK with a particular focus on these new requirements. It details how the requirements are being met and explores the level of ICT skills of new entrants to the profession at the commencement of their training. The results of a large-scale questionnaire survey of student IT capability conducted by the Association for IT in Teacher Education (ITTE) are discussed.

Context

Despite the UK being the only G7 nation to include Information Technology in its National Curriculum requirements for primary and secondary schools, the only country to have at least one computer in all of its primary schools and having the best pupil to computer ratio in the secondary sector, the use of Information and Communication Technology (ICT) for teaching and learning is surprisingly low (RM, 1996). The report pointed out that this may well be due to the fact that teachers have had little in the way of professional development in the use of ICT as a teaching and learning tool.

This was supported by evidence from almost 50 000 lessons and a sample of inspection reports between 1995 and 1996 (Goldstein, 1997). The main findings in this study were that overall standards in IT varied unacceptably between schools and that standards in IT were lower than in any other subject in the National Curriculum. Goldstein commented on the wide range of hardware and software available but noted that the quality of curriculum planning for IT and its application were low. He also recommended that there was a need to improve teachers' confidence in using IT.

With this background the Labour party, then acting as the Government opposition party, commissioned a Committee of Inquiry into the use of ICT in UK schools. The main sources of information for this Inquiry were a six month study by a firm of IT consultants (McKinsey, 1997) and an evidence gathering exercise which received information from over a hundred interested parties. Again the finding supported the previously cited studies and gave greater detail:

- The state of ICT in schools was primitive and not improving
- Much of the hardware in schools was technologically behind the time
- Penetration across schools was extremely variable
- The experience, skills and attitudes of teachers varied widely
- Very little software was directly related to the curriculum
- The way ICT was used varied considerably

This led to the Labour party's manifesto pledge to make increasing the use of ICT in schools a national priority. The issues to be resolved were identified in the McKinsey report as:

- More clarity over objectives for ICT
- Improved training and support for teachers
- More substantial software packages
- Cheaper connections to the Internet
- More up-to-date hardware

The McKinsey report also considered issues related to the use of computers in the home and noted that the availability of computers at home exceeded the availability in schools.

A National Curriculum for ICT in pre-service teacher education

The assessment of pre-service teacher training in the UK became a competency based model in 1992 (DFE/WO, 1992, 1993). The model was revised giving more detail in 1997 (DfEE/WO, 1997), and then in 1998 extended yet again with a focus on core skills (DfEE/WO, 1998). Along with these revisions there was a change in the structure of teacher training: students were now to spend more time in schools working on classroom based activity. By 2000, all new primary teachers will have to demonstrate competency in the core subjects, English, mathematics, science and ICT. A consultation document for each subject was drawn up and sent to interested parties for consultation by the Teacher Training Agency (TTA) The draft document for ICT was distributed in December 1997. This document, *Initial teacher training National Curriculum for the use of Information and Communications Technology in subject teaching* was concerned with the ways in which Information and Communications Technology (ICT) can be used effectively in the teaching of other subjects in the pupils' National Curriculum. It had arisen partly because of the core curriculum requirements, partly because of the concerns expressed in the reports cited above, and also in response to criticism that ICT standards in the existing set of competences for trainee teachers were inappropriate. The 1997 requirements related to the pupils' National Curriculum that was mainly skills based, and did not focus on those pedagogical competences teachers also needed to use ICT effectively for teaching and learning.

ICT is more than just another teaching tool. Its potential for improving the quality and standards of pupils' education is significant. Equally, its potential is considerable for supporting teachers, both in their everyday classroom role, for example by reducing the time occupied by the administration associated with it, and in their continuing training and development. (DfEE/WO, 1998, Annexe B)

These latest requirements came into effect in September 1998. For primary trainees, the curriculum applies to training in the core subjects (English, mathematics and science) and their specialist subject(s). For secondary trainees, this curriculum applies to training in their specialist subject(s).

The curriculum aims, in particular, to equip every newly qualified teacher with the knowledge, skills and understanding to make sound decisions about when, when not, and how to use ICT effectively in teaching particular subjects. ... It is the responsibility of the initial teacher training (ITT) provider to ensure that the ways trainees are taught to use ICT are firmly rooted within the relevant subject and phase, rather than teaching how to use ICT generically or as an end in itself. (DfEE/WO, 1998, Annexe B)

The curriculum is in two sections. Section A focuses on teaching and assessment methods which have a particular relevance to the use of ICT in subject teaching. Trainees are to be given opportunities to practise, in taught sessions and in the classroom a prescribed list of methods and skills (see http://www.tta.gov.uk). Section B sets out the necessary knowledge, understanding, and competence with ICT which trainees need to support effective teaching. Providers of ITT are instructed to audit trainees' knowledge and understanding of ICT.

The onus is on providers of teacher training to ensure that students' competences set out in the document fulfil the requirements at the end of the course, and even here the focus is on delivery through curriculum subjects. However, with increasing amounts of time spent in schools, and with it the increased responsibilities of school mentors, it is here that many of the section A requirements have to be fulfilled. If the evidence of the reports

cited earlier in this paper is to be taken seriously, then it would appear that in many cases schools are unable to provide the necessary support. The Government have made available £230 million for in-service teacher training in ICT with a model based on the pre-service National Curriculum requirements, but this training will not start until April 1999, and even then it will be rolled out over a 3 year period. With low levels of skills apparent in so many schools, there are those who believe that the money made available to support training (approximately £400 per teacher), will be insufficient in raising standards to the required level. A number of projects are already in place which demonstrate willingness amongst teachers to use ICT (e.g. Denning, 1997, Harrison, et al. 1998). However they also highlight the importance of easy or personal access to ICT which, despite increasing amounts of funds being made available, is still not a reality for some years to come. Against this back drop, UK teacher training providers are attempting to ensure that all students meet the rigorous new criteria for competence in ICT.

Preparing students for ICT competence

ITTE members have been working collaboratively in the short time available between the publication of the final version of the requirements, issued in May 1998 and implementation in September of the same year. All institutions are required to audit students entry skills, and ITTE devised an audit which was made available all members. The analysis of the first set of data from 5 institutions indicates the magnitude of the task and is reported below. In addition to the audit, institutions are developing skills based courses; devising portfolio activities for students to demonstrate their skills. This is usually within a subject related task; developing new or rewriting existing courses to include ICT; and writing supporting documentation for the school-based elements of the course. This documentation guides the teacher mentor and the student through a number of steps to ensure that students do have some opportunity to meet the standards, and even suggests alternative activities with school ICT teachers and co-ordinators. Students are asked to keep detailed records of evidence for each of the 39 competences that they have to meet in order to be awarded qualified teacher status. The reality is emerging: in many schools students have little opportunity to use ICT; their mentor in school lacks confidence; and there is a lack of access to ICT resources.

The audit

The audit document was devised from the IT skills requirements detailed in Section B of the pre-service National Curriculum requirements and was administered by five different institutions to primary and secondary students following either one year postgraduate certificate of education courses or three or four year BA courses. It provided students with an opportunity to rate their skills in basic computer related activities (loading software, saving work, etc.) and in a range of generic applications: word processing, desk top publishing, spreadsheets, databases, multimedia authoring and the use of the Internet for communication and information handling.

Responses from 983 students were analysed. Their main subject specialisms included: English, mathematics, science, history, geography, modern foreign languages (MFL) and Information Technology. The students were asked to rate their competence using a simple 3 point scale: competent - could teach a friend, reasonably competent, little or no experience.

Whilst caution is needed in drawing generalisable conclusions from self reported assessments, a number of clear and persistent trends are apparent in the data. The data, see (Tab. 1), is organised by subject and question and shows as a single aggregated percentage the number of students who responded as competent or reasonably competent in each case. In order to draw out patterns in the responses, cells where 60% or less of students responded positively are shaded. This is clearly a somewhat arbitrary figure but was chosen as a threshold that reveals one view of the underlying structure of the data.

The full text of the questions used in the audit has been truncated in the table (Tab. 1) in order to allow the inclusion of detailed subject data.

The original questionnaire was printed as a folded A4 sheet with responses collected using an Optical Mark Reader form and may be downloaded from http://bscw.gmd.de/pub/english.cgi/0/8189648. The data was analysed using Microsoft Excel.

		All	Male	Female	Maths	Eng	Sci	His	Geog	MFL	IT
Word processing	q1.1	94	94	94	97	95	93	96	100	89	100
Databases	q1.2	50	55	50	56	42	60	54	56	32	90
Find Information on the World Wide Web	q1.3	58	67	56	58	54	69	57	67	53	83
E-mail	q1.4	65	68	64	71	55	76	67	71	66	83
Computer Conferencing	q1.5	7	14	5	7	6	7	7	0	2	50
Find Information on a CD ROM	q1.6	63	69	61	66	60	69	61	71	41	93
Programming Languages	q1.7	11	19	8	25	4	15	9	4	3	73
Web Page Design	q1.8	8	15	6	11	5	8	5	4	4	57
Spreadsheets	q1.9	60	61	59	76	47	69	48	73	45	100
Graphics Packages	q1.10	39	48	35	50	29	43	34	52	21	100
Desk Top Publishing	q1.11	34	43	31	45	34	36	30	31	12	90
Logo	q1.12	12	17	10	28	9	13	13	6	6	21
Data Logging	q1.13	23	27	21	23	22	26	20	25	17	57
Control Technology	q1.14	6	15	3	10	6	7	4	4	2	40
Modelling and Simulation Software	q1.15	9	20	5	17	3	14	2	13	2	50
Multimedia Authoring	q1.16	6	15	3	8	4	8	0	4	1	50
Select and run an application	q2.1	88	89	88	93	82	92	84	94	85	100
Cut, copy and paste material	q2.2	86	86	87	89	86	91	75	94	73	100
Format and copy discs	q2.3	64	75	60	66	56	73	56	77	54	100
Create new directories or	q2.4	57	67	54	62	46	63	59	73	52	100
Create 'Back Up' copies	q2.5	55	70	50	63	45	64	59	63	45	97
Carry out virus checks	q2.6	30	45	24	31	25	35	29	31	17	87
Select and set a printer option	q2.7	80	87	77	88	78	88	84	88	72	100
Connect input and output devices....	q2.8	70	81	67	76	63	74	71	81	56	100
Size and switch between windows....	q2.9	57	65	55	60	47	65	55	65	49	100
Use the basic facilities of a network....	q2.10	31	41	26	35	21	36	27	37	18	77
Create links between documents....	q2.11	25	32	22	35	14	33	18	38	16	63
Enter text, correct errors....	q3.1	97	95	98	97	96	97	98	100	95	100
Format text; change....	q3.2	95	94	95	95	93	95	98	100	91	100
Use more advanced....	q3.3	70	72	69	75	60	80	68	83	59	100
Use 'mail merge' to prepare ...	q3.4	68	71	68	78	63	72	66	81	53	100
Create a presentation ...	q3.5	27	32	24	26	20	36	14	27	20	80
Generate indexes, cross references....	q3.6	41	50	38	40	32	45	54	62	38	80
Make use of special character sets....	q3.7	45	50	44	55	26	59	35	46	59	83
Use macros or templates....	q3.8	24	33	21	35	18	27	25	35	20	70
Search using ... simple keywords....	q4.1	67	70	66	72	66	72	64	65	51	100
Search ...using AND, OR or NOT ...	q4.2	51	58	48	53	46	62	48	46	30	97
Use a database ...to extract ... reports....	q4.3	37	43	35	47	33	40	30	38	23	73
Distinguish ... validity and reliability	q4.4	34	48	28	35	35	45	35	25	15	73
Design and create a database....	q4.5	22	28	20	34	19	22	23	15	13	67
Use a spreadsheet to store/print lists/tables	q5.1	64	64	64	84	53	73	55	79	47	93
Use a spreadsheet to sort or select ...	q5.2	52	55	51	61	42	62	48	65	41	87
Use a spreadsheet to calculate results....	q5.3	51	54	50	74	34	62	34	73	34	90
Use a spreadsheet to produce charts....	q5.4	51	55	51	69	37	66	32	67	37	93
Design and create a spreadsheet....	q5.5	33	40	31	53	24	38	23	31	22	77
Send, receive and print email messages	q6.1	67	71	67	74	57	78	70	71	68	87
Organise saved email into 'folders'	q6.2	43	51	41	50	35	53	50	42	42	67
Use 'aliases' or an Address Book....	q6.3	35	42	33	44	31	43	34	35	29	60
Subscribe/unsubscribe from an email 'list'	q6.4	23	33	19	33	18	32	18	8	20	63
... using a text based 'conference'....	q6.5	12	21	8	17	9	14	9	6	4	63
Send and receive files ... using email	q6.6	29	39	25	31	23	33	33	31	30	76
Search an electronic library catalogue....	q7.1	85	87	84	80	87	83	98	88	76	90
Use a ... browser to view pages/follow links	q7.2	61	69	58	63	53	69	59	71	56	83
Use ...browser to save text, pictures....	q7.3	35	48	29	38	30	41	36	40	27	73
Use a 'Search Engine' to find....	q7.4	42	56	36	47	37	51	38	54	38	77

Design and create ... HTML pages....	q7.5	7	13	5	12	5	7	4	4	2	47

Table 1 - percentage of students who responded as 'competent' or 'reasonably competent'

A number of distinctive features are worthy of immediate note. There are clear differences between the reported competence of students with different subject specialisms. This is unsurprising but underlines the need to make differentiated provision in training. Science, mathematics and geography students generally report a higher level of competence than do other subjects in many aspects of the survey with particular strengths in spreadsheet and database activities. IT students regarding themselves as 'competent' in virtually all aspects of IT detailed in the survey except the use of the Logo language. This enjoys a strong following in mathematics in the UK confirmed by the 28% of maths specialists who described themselves as 'competent' in this area.

Many students are confident in their ability to use basic word processing although the use of macros, templates and indexing facilities was understood by less than half the respondents. The use of presentation manager software such as PowerPoint was familiar to less than a third of students. Similarly low rates of positive response are evident for using links between documents and exploiting resources across a network.

Particularly low levels of experience and expertise are indicated for 'new' technologies. Less than 10% of students regarded themselves as competent in Web page design, multimedia authoring and on-line conferencing activities. Only a third or so of students believe they can use a 'browser' programme to save pictures and text for other purposes, design and create a spreadsheet or database or make effective use of a text based 'conference' or email list.

An examination of the data in terms of gender provides another clear and persistent pattern of difference. Overall there is some 8 percentage points of difference between the number of male and female students who describe themselves as 'competent'. This average figure conceals larger differences of around 20% in the 'competence' figures associated with what might be considered the more technical aspects of IT use such as virus checking and making disc backups. A similarly large variation is reported in the ability to use Internet browser programmes to save text and graphics and conducting searches using 'search engines'. However, this may also be due to the commonly held belief that females are prone to underestimate their competence compared to males

Conclusions

The competences described in the new UK national curriculum for initial teacher training are not aspirations or targets but requirements for students seeking qualified teacher status (QTS). The wide variations revealed by the survey confirm the anxieties of many of those engaged in initial teacher training in the UK and will pose a considerable challenge to those responsible for developing and assessing ICT skills and the associated pedagogy. This challenge is particularly acute within the framework of an already condensed and tightly packed programme whether a one year postgraduate certificate of education or a three or four year undergraduate course.

As a first step in addressing these issues a clear grasp of the range of competences which students bring to their training will ensure that strengths can be consolidated and support provided for areas of weakness. Training materials need to be closely targeted or need in order to avoid wasteful repetitive work in areas of established competence and to maximise the efforts of students and trainers alike. The sharp cut off between basic skills and more sophisticated use suggests that even well established users of the technology rarely take advantage of the efficiencies that the effective use of modern software applications makes possible.

We live in interesting times!

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The Barefoot Teacher on the Telematic Highway - Serving Rural Communities in Kwa Zulu Natal

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Abstract: The Department of Community Nursing and the Open Learning Centre of Technikon Natal, and the community owned Community Development Programme are collaborating to provide online learning to rural and urban community nurses. The project involves the development of a multimedia pharmacology course, a virtual Internet class and the provision of information points (tele centres) in factories, rural police stations, refitted containers, and the like. This is a response to the acute need for training of community nurses operating under difficult conditions, with few resources, in primary health care settings in Kwa Zulu Natal.

Background and Problem Statement

The Natal Technikon's Department of Community Nursing, in association with Open Learning Centre at the same institution, has initiated an on-line certificate course, in a joint venture with the Community Development Programme.

In keeping with the larger objectives of the new South African National Qualifications Framework, i.e. to facilitate access to, and mobility and progression within, education, training and career paths, these departments support the rationale for restructuring South African education by the South African Qualifications Authority (SAQA). They recognise that telematic learning lends itself to Outcomes Based Education (OBE) in both style and philosophy.

"One of the saddest achievements of widespread public education in the twentieth century was the embedding of an attitude that education was about certificates and status but had little relationship to the way one lived one's life or did one's work. The attitude was intensified in apartheid education. This could even be reflected in critical and radical action, where we still find supposed change agents who know all the words about critical pedagogy and empowerment, but cannot suggest one practical way of enacting these abstractions in real places and lives of real people." (French 1997)

Therefore the Community Nursing project, which involves developing in-house courseware and a virtual classroom on the Internet, to meet the needs of the nurses stationed in remote areas - this in addition to the more usual teaching methodologies reflected in the existing pharmacology course. Urban community nurses based in factory clinics and urban primary health care points would also gain much from this distance course with regard to recent advances in distance education.

It is relatively easy to involve urban post-graduate community nurses in vital training required to equip them for significant changes in their roles - changes brought about by recent access for all South Africans to primary health care. Nurses in the rural areas, however, where there are few doctors and even fewer facilities, have little or no access to the information they need to carry out duties for which they have not been adequately prepared.

Apart from the problems of distance and suitable times usually associated with the need for online learning, there are few telephones, a rudimentary electrical power infrastructure, and a lack of computer literacy on the part of the nurses out in the rural areas. Access to service and repair of equipment is non-existent.

Crucial considerations are:

- the rural communities are fiercely suspicious of projects which they do not initiate themselves, for obvious reasons,
- once accepted and put in to place, the projects need to become self sustaining, and
- each project should contribute to the development of the community holistically.

The Community Development Programme Involvement

The Community Development Programme (CDP) operates a system whereby people with identified needs are formalised into small groups, and are then assisted to meet their needs by training, business mentorship and/or other forms of practical help. (Further details on the CDP can be found at http://www.cdp.ml.org.)

The CDP enjoys large-scale support by rural communities and CDP community facilitators will ensure acceptance of the Department Of Community Nursing's distance learning programmes.

Furthermore, the CDP is in a position to involve Telkom (telephone and Internet services) and ESKOM (electricity) at post offices, army bases and police stations for suitable placement of training centres.

Therefore, the CDP has been commissioned to identify and prepare suitable facilities for training the nurses, using already identified community information centres such as schools, post offices, police stations, factories and municipal offices. Each centre would be need to be equipped with a phone line, modem and computer and funding for Internet operating costs by the community itself with loans from the CDP National Trust Fund. These will be known as CDP Telecentres.

Where there is extreme need and severe lack of facilities, the CDP is seeking corporate social responsibility funding to equip large shipping containers, already donated to the CDP, with necessary

technology - a generator and cell phone, if needs be - as an information/training centre. The use of wireless Internet technology and cell phones are being investigated as a practical solution to the absence of telephone lines.

The Community Development Programme (CDP)

South Africans of European origin often find it difficult to relate to the concept of community life. They tend to be trained to be independent and self-sufficient. To rural Zulu's the concept of community based life style is obvious and normal. They share facilities, work together towards the common good, share a common identity and tend to be transparent with each other. This often creates a culture of rejection and suspicion when Western business practices intrude into rural life in the form of social corporate responsibility initiatives.

The Community Development Programme tries to bring the two philosophies together, so that communities can benefit from corporate involvement, and develop their own forms of commerce and trade without being disempowered. The CDP aims to educate and train participants to meet self-identified needs, and to provide access to corporate resources and infrastructures, so that communities and, ultimately, individuals can become financially independent and self-sustaining.

The programme endeavours to set in motion a process of economic and social empowerment by stimulating the creation, and equal distribution, of wealth by using participating communities' resources, abilities and consumer buying power to their own advantage. The participants are managed at a highly competent level, consulting with and being guided by qualified leaders in specific areas of expertise, employed in the geographical areas of the local communities.

The Open Learning Centre's Involvement

The Open Learning Centre at Technikon Natal, Durban, South Africa, has embarked on authoring the pharmacology course. The course will be made available to registered nursing students via the Internet, and on CD-ROM with accompanying work books.

The pharmacology course is the first of the in-house multimedia courses being developed, together with a course in basic physiology for the Human Biology department at Technikon Natal - also for the Faculty of Health. Both multimedia courses will undergo alpha testing in the first six months of 1999 with the help of currently registered students.

Currently, two virtual class sites exist on the OLC Web server, with several others in preparation. The Technikon Natal Community Nursing homepage will be in operation by early next year as corporate sponsorship has been found to run it. (Find the OLC homepage at http://www.olc.ml.org)

The Open Learning Centre's Operations at Technikon Natal

The mission of the Open Learning Centre (OLC) is to offer services, training and support that enable the academic departments of Technikon Natal to develop, implement and research their own telematic teaching and learning resources

Current services comprise:- on-line learning and computer aided instruction for students in key subject areas; development of courseware for academic departments; training and workshops on how to write and develop courseware; and telematic consultative services.

Lecturers from academic departments accompany their students and act as facilitators during weekly computer-assisted learning tutorial sessions. All sessions are time tabled and compulsory (i.e. attendance remains high throughout the year). Most of the sessions are credit bearing (i.e. academic departments allocate marks for completion of lessons on computer).

The OLC multimedia training room is used to prepare academics in the use of telematic teaching and learning technologies. For example, the training room is used by computer studies lecturer Parivash Khalili to teach the subject Operating Systems IV. Her B.Tech Information Technology students make use of the training room in order to access their virtual class on the World Wide Web. First year Residential Childcare students make use of multimedia resources on CD-ROM for the completion of a credit-bearing project.

The OLC's approach to courseware design is to train academics to become involved in "low level" courseware development that is easy to learn and do. OLC staff members co-ordinate the development process and are involved in "high level" development requiring scripting and other specialised skills. The OLC also provides access to courseware development resources such as scanners and software.

A number of workshops were delivered to lecturers during 1998, primarily on designing and managing virtual classes, and on using the World Wide Web as a teaching and learning resource.

The Department Of Community Nursing's Involvement

The Community Nursing Department is providing the learning material, evaluating the students and managing the pharmacology course. The Department has organised subject expert, Beverly Gold, to write the courseware content and accompanying literature. A full time staff member will operate the virtual class, workshops and online student assessments from the inception of the course in July 1999.

There are no successful distance-based programmes in this discipline in South Africa. There are a number of registered nurses working in varying sizes and types of occupational settings throughout the country, and further north, who are unable to access formal education and training in community health nursing.

If the pharmacology course proves successful, other primary health care courses will be developed along these lines. Nurses in the field are experiencing great problems with the introduction of free primary health care to all South Africans under the age of six. There is a severe shortage of skilled health professionals in the field and nurses have no access to the information they need on a daily basis, and little time or opportunity for upgrading their skills.

The Department Of Community Nursing At Technikon Natal

Courses are offered in occupational health nursing and primary health care.

In addition to Internet-mediated learning, video technology is also a medium that is being explored by this department. Plans have been put into place to translate one specific programme - a post-graduate course in occupational health nursing - into video and supporting workbook format by the end of 1999. While video material seems to be much more accessible as a means of delivery in the United States, the dollar/rand exchange and the different cultural context, makes it necessary for the department to produce its own video material. Extracts from these videos will be used in the interactive and online courses. The occupational health nursing course, recognised by the South African Nursing Council, has been chosen as it is not dependent on clinical instruction, nor does it necessarily require synchronous lecturer/student contact.

A small but comprehensive studio is being adapted in, and for, the department. Computer technology will be incorporated in the making of the videos. While only 50% of the target group is likely to have access to video machines, the programme is planned so that the workbooks will be sufficient to sustain the learning process. The videos will enhance the concepts and serve to motivate students and provide video clips for the CD-ROM courses.

The Department of Community Nursing is extremely flexible and intends to exploit all the forms of communication to which students have access.

In Summary

It is our belief that we do not need to repeat previous technological learning curves. While we have our own unique learning to do in this field, we can simply plug in to the opportunities afforded by the expertise, wide experience and effective telematic technologies, developed by the United States, and simply get on with the urgent need to train our nurses. Our country's training and health care problems are truly desperate. This collaborative multi-modal project by the Department of Community Nursing, the Community Development Programme and the Open Learning Centre at Technikon Natal is one attempt to reach into the rural communities themselves and to bring equality of opportunity and equal access while providing health care.

Fortunately online learning/teaching technology is relatively cheap, suitable for our needs and readily available. From the point of view of experience in the field of telematic learning and teaching, we consider ourselves to be "barefoot", technologically speaking. By firmly directing our "barefoot" teachers and lecturers, and their students, on to the information super highway, we may be able to address some severe problems. Lack of training has lead community nurses to dispense antibiotics to children, which has resulted in them becoming deaf. We need to reach community nurses with the information and support they require in order to operate effectively under difficult and trying conditions as soon as possible.

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IT POLICY AND THE DEVELOPMENT OF HUMAN RESOURCE IN SINGAPORE

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Abstract

IT and R&D have contributed much to the development of Singapore. Although the advantages of using IT is obviously, IT should be seen as a *supplementary source* rather a *substitute good* and IT policy should be designed in such a way that it will not "dehumanize" human beings.

This paper consists of three parts. The first part will introduce IT policy in Singapore, which contributes to make Singapore become a "more advanced developing country" in January 1996 *(//www.nus.edu.sg).* The second part will discuss the opinions of people about IT in Singapore, based on the data collected from a mini survey in 11/1998. The last part will give suggestions to balance IT and human resource development.

In short, computerization and IT play a very important role in our life. However, the question of whether IT may dehumanize the users should be discussed among academics, scientists, policy makers and those who are interested in the theme "*Advanced Technology versus Human Factors*" .

IT POLICY IN SINGAPORE

Besides the investment in general education, Singapore also aims to prepare Singapore to be an "Intelligent Island" with an advanced nation-wide IT in the next century *(Mr. Peter Chen, 5/1998).* A six-year IT Master plan has been implemented at primary and secondary levels. In addition, Singapore has also invested in IT development at tertiary level as well as has introduced IT to everyone through Singapore-One - the national superhighway.

1. IT at schools
MOE has recently had an IT Master plan. The plan aims to achieve a 30 % of curriculum time using IT with a pupil-computer ratio of 2.1 for every school by the year 2002 *(RADM Teo Chee Hean,1997*). MOE has concentrated on 3 major programs, namely "Accelerating the Use of IT in Primary School (AITP), Student's and Teacher's Workbench (STW) and JCNet.

The AITP project has introduced multi-media teaching in 6 pilot primary schools since 1995. Pupils have spent about 10 % of curriculum time using IT. Initially, schools have been provided with the pupil-computer ratio of 6.6:1 (*MOE, 1997*).

The STW project introduced a 30% IT-based curriculum in Secondary 1 Science to 6 pilot secondary schools in 1996. The project will be extended to Science at Secondary 2 in these 6 pilot schools. Secondary schools have been given an initial pupil-computer ratio of 5:1, enabling IT to be used for 14% of curriculum time *(MOE, 1997*).

The JCNet introduced an R&D project on the use of Internet to 2 Junior Colleges in 1997. Junior colleges have also been provided an initial student-computer ratio 5:1. Then, the project will be expanded to other school.

Overall, the Master plan has been implemented in 3 phases: phase 1 (1997) - 22 pilot schools, phase 2 (1998) - 86 schools and phase 3 (1999) - 254 schools (*MOE, 1997*). Singapore government has spent US$1.2 billion for this 5-year plan *(RDAM Teo Chee Hean,1997)*.

2. IT at The National University of Singapore (NUS)

To achieve academic objectives and to make NUS become a "Harvard University in Southeast Asia", National University of Singapore emphasizes on eight main streams:

(i) ***Campus-wide Networking*** provides students in campus with useful devices, including an ATM backbone with switched LAN hubs;

(ii) ***Global Networking*** (Internet/Intranet) allows staff and students to easily access Internet and Singapore ONE to get IT-intensive virtual information with multimedia content;

(iii) ***Client/Server based Integrated Information Systems*** allows users to transact directly without administrative intermediaries so as to increase productivity and speed;

(iv) ***Smart Card Based Infrastructure*** serves the multi purposes of personal identification and secure physical access to resource centers;

(v) ***Remote Lecturing & Computing*** allows students to reach teaching programs from foreign universities and from their niche expertise;

(vi) ***High Performance Computing & Visualization Support*** provides supercomputing technology to solve diverse scientific and engineering problems;

(vii) ***Online Transactions*** increases the speed of academic transaction, such as registration, exam results, application and other Q&A; and

(viii) ***Library Information Systems and Video-based Services*** help students get information from World Wide Web (WWW), international conferences and lectures of foreign prominent scholars, and from other educational and training programs and so on *(http://www.nus.edu.sg)*.

3. Singapore ONE: IT for everybody

Singapore ONE is the national IT highway which connects business areas to local access networks. With Asynchronous Transfer Mode (ATM) technology, the network provides users with voice, data, audio and video information inside the country as well as from overseas sources. Users can access Singapore ONE through Singapore Telecom and Singapore Cable Vision, current local network operators, and from certain public kiosks. The Government strongly supports this project with S$150 million invested in infrastructure and financial programs for Singapore ONE business partners *(1997 National Computer Board, Singapore)*.

For general public, Singapore ONE helps to deliver government's information, public services and business information, such as banking, shopping, entertaining, education, etc directly to households. For private and public sectors, it provides faster channel of information, which can achieve better service, better advertisement and bigger market-share. For educational and R&D sectors, Singapore ONE supplies an excellent foundation through which new technologies can be built. For overseas business partners, Singapore ONE helps to enhance Singapore's competition and to enter into the vibrant regional and international markets *(Dr Tony Tan Keng Yam, 1997)*.

Besides Singapore ONE, IT200 Vision and BookNet campaign were also introduced in Singapore to contribute to the development of IT.

FINDINGS ABOUT THE OPINIONS OF SINGAPOREAN PEOPLE TOWARDS IT

Although, nobody can deny the crucial role of IT in many industries, there are different perceptions and views of Singaporean people about IT and Human factors.

This part will present some findings, which results from a mini survey, conducted in 11/1998 in Singapore. The questionnaires were distributed among 48 students, professionals and administrative officers as well as others (from 17 to 41 years old) who are considered to have knowledge about IT and they will be the main forces to use IT in the next century (Table 1).

Table 1: Profession of the interviewees (%)

Students	*Professionals*	*Administrative Officers*	*Others*	*Total*
37.5	18.75	16.67	29.17	100

These people have at least Diploma qualification and there is even one person with doctorate degree (Table 2).

Table 2: Profession of the interviewees (%)

≤Diploma	*Undergraduate*	*Bachelor*	*Master*	*Doctorate*	*Total*
62.5	14.58	10.42	10.42	2.08	100

Due to time constraint, the sample size is small, so the findings may not represent the ideas of the whole population. However, the survey can help readers have a general view about the knowledge and the understanding of people in Singapore towards the IT policy.

Only some selective questions and information, which suit to the theme of the paper, have been presented here. The data, which reflects opinions of people living and working in Singapore towards IT, can be summarized in the table below.

Table 3: Summary of the data collected from the survey (%)

Questions	*Yes*	*No*	*Other ideas*	*No idea*	*Total*
Do you like to have a multi-functional computer (as a robot)?	39.58	45.83	8.33	6.25	100.0
Do you know anything about IT policy in Singapore?	12.5	68.75	12.5	6.25	100.0
Do you think new generations become 'lazier" because of using computers?	41.67	39.58	18.75	0.00	100.0

(i) From Table 3, 39.58% of the interviewed people said that they like to have a multi-functional computer (as a robot) because it would help them to save time and would work more efficiently, more reliably as well as it would obey them with no condition. However, 45.83% of the interviewees did not like such a machine since they needed human touch and they would feel useless if the machine would do everything for them. In addition, without electricity, such machine would become paralyzed. The rest (14.59%) had other ideas or no ideas about having such a machine. Among these people, one person said that he liked it but if he had a choice, he would still prefer human being, 3 interviewees answered that they would treat the machine as a maid.

(ii) Although IT has been developed widely from primary to tertiary and for everybody, only 12.5% (6) of interviewees knew about IT policy in Singapore. However, only 2 of them mentioned to Singapore ONE, 1 mentioned to National Computer Board and IT2000 plan and 3 of them just stated that "IT will make Singapore become an intelligent island". Most of them, 68.75%, did not know anything about IT development in Singapore and the rest used common terms to answer (12.5%) or did not answer (6.25%).

(iii) With regards to the 'laziness' of the young generations, 41.67% of the interviewed people agreed that sitting in front of computer all the time would make young people lazier and made them lack of exercise and other activities. In addition, the young may become computer-addicts as television-addicts. On the contrary, 39.58% of the interviewees did not think that the young would become lazier if the latter knew how to allocate their time properly. They also added that computers would free the young from manual work so that they would have more time to do other things, such as doing exercises, reading, entertaining and so on. The rest 18.75% had some other ideas, such as the new generations may become lazier (3 persons) or it

depends on the family culture and education (4 persons) or either case may happen due to other subjective reasons (2 persons).

(iv) One interesting finding is 12.5% of the interviewees thought that computers could replace men in the future. They imagined about a computer with "human brain" which can function as a human. Although, we all know that computers are made and programmed by human beings and human beings are unique with emotion and behavior, the idea seems quite attractive and it may open a new trend for computer producers and robot scientists. The rest did not agree that computers would replace men in the future or they had no ideas about the issue.

(v) When being asked "What is IT?", many people (25%) did not know how to answer the question. Some of them (25%) just mentioned "computer". The rest had been responded differently as follows:

- IT relates to computer science and the modern world
- IT means computer data, technology and Internet
- IT is a new high-tech way to arrange information
- IT is a better way to transfer information
- IT is a way to gather, process and present data using electronic devices like computers
- IT is the use of computer, microchip, high-tech equipment to generate flow of information
- IT means computer and media
- IT is technology on processing information based on automated algorithm
- IT refers to E-commerce, EFT, EDI, etc.

According to Longman, Dictionary of Contemporary English, information technology (IT) is "the study or use of electronic processors for storing information and making it available". Therefore, it is obviously that very few people really had a clear concept about IT though they have had chances to know about IT at schools (all of them have at least diploma degree) and at the work place. They may just know how to use computer rather than utilize them for special purposes.

(vi) With regards to the advantages and disadvantages of IT, various ideas have been presented (in short form) as follows:

Advantages of IT	*Disadvantages of IT*
- faster information and work	- making people lazier
- multi-function	- expensiveness
- various data	- technical problems
- accuracy	- waste of time when computer breaks down
- convenience	- individualism
- effectiveness	- no creativity
- duplication (can help to duplicate)	- lack of basic skills (handwriting, spelling)
- paperless	- no movement, less outdoor activities
- efficiency	- eyes and health problems
- fewer errors	- no personal touch
- providing vital information	- viruses
- order/neat manner	- illegal flow of information
- store data and data last longer	- hardly catching up with technology
- cheaper way to get information	- millenium bug
- straightforward manner	- communication problems
- making the world smaller	- mistaking knowledge for information
- use of software for presentation and	- isolation
- research	- security problems
- automation	- over-relying on IT
	- social structure change: IT and Non IT
	- people may lose jobs

Among the above-mentioned disadvantages, technical problems and human factors (health, personal touch, communication, time, etc.) are highlighted by most of the interviewees. It is

worth recognizing that people do not accept IT and other high-tech forms without thinking about the two sides of a coin. Thus, a strategic policy to balance the development of IT and the development of other skills should be paid more attention.

BALANCING IT DEVELOPMENT AND HUMAN RESOURCE DEVELOPMENT

There are some points needed to be discussed in relation to IT policy in Singapore. Firstly, the government concentrates mainly on macro level, while at micro level, policy is not well spread. A good example is that only 12.5 % (6 persons) of people interviewed know about IT policy in Singapore and only 2 of them mentioned about Singapore ONE, which is supposed to bring IT to everyone. This means that the main objective of IT policy is not totally achieved.

Secondly, while concentrating on training new generations (at school and tertiary levels) as well as facilitate businessmen and entrepreneur with IT tools, the policy somehow ignore the old and the middle-age generations. As a result, a big gap between skilled and unskilled workers, in terms of IT knowledge will be inevitable. Those who are not provided with IT skill will be out of work through "natural retrenchment". Therefore, dramatic changes in social structure can be seen clearly. There are also two trends towards IT and high-tech: pro and con. Those who can use IT and high-tech devices will make use of these devices to make their life better, to get better jobs with higher pay. On the contrary, those without IT knowledge will blame that IT and high-tech devices ruin their lives, i.e. make them unemployed.

Moreover, the high cost of IT courses will also cause widen the gap between the rich and the poor. The high-income people are able to afford the tuition fee of IT courses for their children, while the low-income people are hardly to pay for their children's schooling and even for themselves when they want to enhance their IT knowledge. Although the government co-operate with the Labor Union and the Ministry of Manpower to launch subsidized programs to retrain and upgrade workers with IT and business skills, these schemes cannot completely meet the high demand of training and re-training workers.

Thirdly, if the government concentrates too much on the development of IT industry, a shortage of manpower in other industries will occur sooner or later. At universities, students will enroll in IT courses and other subjects (Finance, Business Administration, and Law), which can help them find good jobs and high pay in the future. They will spend more time for IT activities than for others. They may not acquire other necessary skills which are not less important than IT skills in life.

Therefore, some recommendations are made as follows:

(i) Policy makers should make strategic policies to balance the development of IT and the development of human resource. A balance investment to professional development and to personal development should also be considered.

(ii) Policy makers should make policies at both macro and micro levels as well as aim at all groups in the society to prevent adverse effects of changes in social structures. Since it needs time for exiting labor force to adapt with high-tech environment, a comprehensive IT master plan should be phased out. This includes giving IT training to all groups in the society, either for career development or for personal use.

(iii) Young people should be encouraged to allocate their time for all necessary activities rather than concentrate only on acquiring IT skills. They should understand that IT, computers and other high-tech devices are means to help them achieve their objectives. Thus, they should control these tools rather than let these tools control their time, their activities, their emotion and behavior.

CONCLUSION

IT will certainly play a crucial role in the economic and social development as well as in the recovery process of Singapore. Without IT knowledge, people will naturally be "dropped" out of the labor market. On the contrary, lacking of other basic life skills can also cause serious consequences to people. It will be a tragedy that in 10 or 15 years, all the young people will only know how to sit in front of the computer, work with computers, play with computers and give command to the old workers, who will work as blue-collars for the rest of their lives.

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The Teacher Professional Training in the New Technologies Surroundings

/An Experience on the Project TEMPUS - S_JEP- 08801/

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Abstract: In the present work some of the problems connected with the introducing of the new technologies as an environment for teacher training have been analyzed and the experience of the authors in this field is shared, such as:

- The variations of the professional record of the teacher and a formation of new specific teacher characteristic as an educational information technologist;
- The variations of the ways and language of communication and a confirmation of new culture;
- The qualification of the university lecturers;
- The actualization of the curriculum design and course design.

The summarization and the research results are authors' three-year experience outcome while working on the project TEMPUS - SJEP- 08801.

Since 1994 Structural Joint European Project /S_JEP/ has started. The title of the S_JEP is: Development of a Bulgaria network for the training of teachers in Information Technologies. The Objective was: The project will establish in Bulgaria an extensive and modular program of in- and pre-service education for teachers in the uses ICT as learning technology. Its award structure will be recognized nationally within the Bulgarian University system and its recognition at the European level. Distance teaching, using electronic mail, will be an important feature of the program.

A Contractor of the Project was the Free University Brussels, Belgium and a Co-ordinator was the Sofia University "St. Kliment Ohridski", Sofia, Bulgaria. The Participating Institutions were: Manchester Metropolitan University, Manchester (UK); Carl von Ossietzky- Universitat Oldenburg, Oldenburg (D); Shoumen University "Konstantin Preslavski", Shoumen (BG); Free University of Bourgas, Bourgas (BG); University of Veliko Turnovo "St.Cyril and St. Methodius", Veliko Turnovo (BG); In-Service Teacher Training Institute, Stara Zagora (BG); Institute for Higher Teaching Qualifications "Dr. P. Beron", Varna (BG); Bulgarian Academy of Sciences, Sofia (BG); National Center for Information and Documentation, Sofia (BG).

Activities and Outcomes

During the first project year computerized study centers for the training of teachers in IT in the partner institutions were established and project members were trained in a number of aspects concerning the implementation of IT in education. During the second and the third project year those centers were equipped further with additional modern facilities and accessories thus providing a functional basis for the development and running of various course modules. Activities carried out in the frame of the project were supported by local institutional authorities and appropriate work conditions were provided for working.

Curriculum Development

The general curriculum "Audio-visual and information technologies in education" was developed and officially recognized by the Ministry of Education during the second project year. During the third year the curriculum

was enriched by a number of new courses and modules developed by the project members in the relevant institutions. Existing courses were enhanced through including new elements in them, techniques for collecting feedback, team work and students' projects, etc.
All restructured as well as new-developed courses have been recognized at faculty and institutional levels. Faculty boards and other authorities have given the full support needed for the courses to be included in the institutional programs.
A description of the courses (modules) run during the third year is given in the table below. Some of the courses were given for students from Faculties and Departments different than the main participating faculty.

Institution	No of Course (module)	No of hours	Target group	No of students
Sofia University	10	280	full-time and part-time students	700
IHTQ Varna	9	350	teachers - various subject areas	100
ITTI Stara Zagora	12	500	teachers, institutional staff	240
Bourgas Free University	9	290	academic staff, teachers, full-time students, part-time students	410
Shoumen University	9	400	academic staff, teachers, full-time students, part-time students	320
Veliko Tirnovo University	7	200	academic staff, teachers, full-time students, part-time students	200

Table 1: A description of the number courses and students

Teaching materials

A significant number of teaching materials was developed during the third project year. Created mainly by the project team members they embody the hard work put in delivering courses, consulting and helping the students to learn more effectively. The study materials reflect concrete local needs regarding the target groups, the hours of study, the interests and inclinations of the audience.
Some of the materials are authoring (created by a single author or developed jointly in co-authorship), while others are translated and adapted from the materials gathered during mobility to the Western partner institutions. Listed below are some of the already produced and completed materials:
- *Strategies for Implementation of Internet in Education (reference)* - D. Pavlov, R. Peytcheva, V. Poplilova.
- *Eudora Light (study guide)* - L. Genov
- *Library of Students' Didactic materials (implying different ICT in teaching-learning process)* - R. Peytcheva
- *Handouts* - Hierarchical file-tree structure (authoring), Introduction in the Internet, Glossary of Internet terms (translated) - V Poplilova
- *CorelDraw - beginner's guide* - C. Zafirov
- *Eudora - a study guide* - A. Doncheva
- *Library of students' works; Study guides (ICT and Audio-visual courses)* - M. Zheleva, M. Madjarova
- *Methodology and Technology of Test Design (guide)* - M. Zheleva, M. Madjarova in co-authorship with Prof. A. Libotton
- *Student's manual to the Internet* - G. Jordanova, M. Ivanov

Being unique and original the materials correspond to the requirements of the actual teaching and learning process in the local institutions. Created with the intention to ease the implementation of IT in education the study materials have proved to be appropriate and suitable for the purpose. Through trailing and feedback obtained from the trainees the collected data show that the materials are useful and much needed. Feedback has been used also as a basis for correcting and enhancing the teaching materials.
Developed study materials are successfully used by the project team members in their everyday work in delivering courses. They are available to all partners within the project as well and thus form a significant collection of study materials to be exchanged and enhanced by introducing new ideas and elaboration.

Putting the study materials created within the project into a shared database could be an useful and important source, demonstrating the sustainability of the project. Such an activity is envisaged to be included in the new Tempus CME project proposal.

Staff development

Staff development continued during the project's years in the already known pattern - through mobilities to the Western partner institutions, self-educating and updating knowledge and skills, and through participation in national and international workshops and conferences.
Mobilities to the Manchester Metropolitan University, Free University of Brussels and the University of Oldenburg were much successful and useful. Based upon the already established contacts with foreign colleagues, mutual collaboration and work took place in different areas and aspects of IT implementation in education. Topics of specialized professional interests were discussed and places equipped with up-to-date facilities were visited.
Apart from the educational matters observed and discussed, staff members were given opportunities to get ideas about various aspects of organized activities within a single educational unit (department, faculty, institution) and get acquainted with some issues of management, hierarchical structuring, responsibilities, working in a team, etc.
Retraining of staff is an important achievement for the beneficiary institutions. Obtaining valuable expertise in the field of using IT in education, the team members are the well-trained and informed people who deliver interesting and appealing courses, provide help and instruction to the other institutional staff (academic and administrative), explain main principles of electronic communication and browsing through the Internet.
Dissemination of staff training to other colleagues from beneficiary faculties (institutions) is done mainly through short-time courses, consultations and workshops. Developing mutual projects and cooperative work with some colleagues is also a way to spread knowledge and skills in IT through implementing it in the real practice. Main benefits for the academic staff trained by the participants are acquiring and updating knowledge and skills in the use of ICT and networking, updating knowledge and know-how in curriculum development, testing and evaluating procedures, access to specialized literature on ICT, networking and education, etc.
Some partner institutions established and developed fruitful cooperation with secondary and high-schools in the relevant region. IT courses were run with teachers and with outstanding students who are interested mainly in communications and using the Internet for educational goals. The team from IHTG Varna gave significant help and support to the Fifth Language School and the Third specialized school (science and mathematics) to develop and carry out educational international e-mail projects. Students' and teachers' essays were published via Netnews in the Internet. The Language school prepared and published its own Web page.

Articles

During the official meeting with the Contractor and representatives of the Bulgarian partner institutions in February 1997, a decision was taken for the creation of a collection of articles to reflect some theoretical views and ideas, as well as the practical experience of the team members in field of introducing IT into the teacher training in Bulgaria. Therefore there is no main uniting topic of the collection, but revealing personal views, attitudes and good practice the authors are actually disseminating project results and generalizing the overall impact of the project upon the development of the Bulgarian educational system.
The graphic design, editorial work and the final preparation of the collection for publishing was done by the project team members from Shoumen University - G. Jordanova and M. Ivanov.
Other articles in the field of implementation of ICT in education were written by the participants in the project and published in a number of Bulgarian and some foreign popular and specialized journals and magazines, as well as in collections of reviews presented at different national and international conferences and seminars .

Abstracts' Database

The database of abstracts of articles designed by the end of the first project year was enriched with additional records written by all partners. Interesting and useful abstracts in various IT related subject matters, new research results, technical information, etc. can be read from all participants, as well as by others - students, teachers, post-graduates and educators who are interested in up-to-date achievements, trends and developments.

Equipment

During the third project year the final completion of equipment provided for the local ICT centers was finished. Items were purchased according the specific needs and fields of professional interests in the partner institutions. Additional hardware, software and accessories were supplied to provide the needed basis for updating the existing courses (modules in computer graphics, audio-visual aids in education) and the development of some new modules (multimedia, creation of Web pages, etc.)
Equipment bought in the third year was installed and tested successfully and fully integrated into already existing local area networks and the overall infrastructure of the institutions. Thus the local IT centers turned into effectively operating study centers - reliable facilities for provision of IT courses, self-education, information exchange, communication, etc.
Functioning of the electronic connection between the institutions was in general satisfactory. For fast and reliable communication the partners used the e-mail. All had an almost permanent access to the Internet which helped the development of a number of communication modules, carrying out e-mail projects, running communication courses.
Maintenance of the equipment was provided by the services of a part-time technician at the Educational Technologies Center - Sofia University and by the project team members in the partner institutions. Permanent support and help in the maintenance of equipment was given to the team members by system administrators of local servers and by some colleagues (computer specialists) from other faculties. Through involving other people in such kind of mutual collaboration professional relationships were further developed and strengthened, which is another way of broadening project activities and dissemination of Tempus ideas.
Equipment installed in the beneficiary institutions is used by different groups of people, including: full-time and part-time students from the beneficiary faculties and from other faculties and departments in the relevant institution; colleagues (academic staff) from the beneficiary and from other faculties; post-graduate students; secondary and high-school teachers; secondary and high-school students (pilot experimental courses).
Provision of equipment is the main prerequisite for the fulfillment of all other project activities, as well as for any further developments of project ideas within the institutions and beyond (after the end of the project). Local computer study centers and libraries were used as basic facilities for running short and long-time courses, carrying out introductory and retraining seminars, access to and exchange of professional information, communication between colleagues locally, establishing links with partners within Bulgaria and abroad, carrying out communication projects, production of study materials, generating of new ideas related to the implementation of ICT in education and so on.

Functioning of the Network

Professional relationships and collaboration deepened through mutual collaboration in educational projects (using the e-mail), in the discussions during official meetings and visits to partner institutions concerning the curriculum development, the preparation of project presentations (Official Tempus Open Days - for North Bulgaria, South Bulgaria and in Sofia), the impact and sustainability of the project outcomes, the dissemination and popularization of project results.
All project participants shared valuable ideas and "know-how" between themselves, gave suggestions for continuation of the work started and developed within the project. As a result of such mutual activity targeted towards future development, a Tempus CME project proposal was elaborated. All partners took part in several discussions at a workshop (Sofia, Vitosha, 16-21 August 1997) defining the objective, activities, management and the overall structure of the CME project. This year the CME- project starts. The collaborative work proved partner relationships actually subsist, they "work" and are the grounds for achieving fruitful results.

For all partner institutions (beneficiary departments) except Sofia University the present project was first acquaintance with the Tempus program - its main ideas, rules, way of functioning, possibilities, etc. Gradually partners got used and familiar to the character and organization of work done within the project. Putting deliberate efforts in it the team members acquired significant expertise in using and teaching ICT to different target groups in Higher Education. They developed skills for updating knowledge, searching for sources of information, established valuable contacts with EC partner institutions and colleagues. Introducing the use of new Information Technologies and related to them innovative methodologies in teacher training, the project team members comprise a vital and important part of the relevant institution' academic staff. Training and experience acquired within the project will be spread further through the recognized courses in ICT, thus providing a long-term sustainability of project results and meeting some of the needs for innovating the system of Higher Education in Bulgaria.

Achievement of Outcomes

Achievement of outcomes was obtained through the fulfillment of a number of basic activities. Activities and outcomes are pointed in the Table 2.

Outcome Achieved	Activities Carried Out
Equipment provided, implemented and evaluated in the institutions	- Additional equipment provided in eligible institutions - Equipment integrated and implemented in institutions infrastructure - Functionality of equipment evaluated
Network functionality evaluated through mutual network-projects and network implemented in institutions through cooperative developments	- Further try of network links - Participation in network-projects with students' groups - Cooperative developments through network use - Evaluation and implementation of the network in the institutions
IT course modules integrated in the institutional programs	- Adaptation of course modules and study materials to local institutional needs - New modules and teaching methodologies developed and old ones updated and enhanced - IT modules trailed in the educational process, feedback obtained and evaluated
Acquired up-to-date knowledge and skills in the field of IT and education by the staff, enhanced expertise in teaching practice	- Retraining of staff (mobility) in specific aspects of the project objectives: * updating knowledge and skills of course and program development, monitoring and evaluation * further updating of knowledge and skills in curriculum development, evaluation and implementation * acquiring knowledge in some aspects of current IT development, networking, methodology of IT-based training
Curriculum implemented at institutional level	- Project based (global) policy for curriculum implementation adopted between the partners - Institutional based policy for curriculum implementation adopted locally by the partner institutions

Table 2: Achievement of Outcomes

Conclusions

Key successes of the project in terms of the target groups

All target groups were trained according their specific educational needs (goals and outcomes), professional interests, inclinations and orientation and according the local conditions - period of training, level of acquired knowledge, equipment and facilities available, etc.

The key successes of the project regarding all target groups of trainees (see table of courses above) refers to:

- acquired knowledge and skills in the use of Information and Communication Technologies;
- obtained general view of the possibilities to use ICT for educational purposes and their actual implementation in the educational process;
- obtained methodologies of teaching ICT - concepts, methods, forms, approaches, evaluation and testing procedures, etc.
- practical application of new knowledge and skills in the development and completion of concrete educational projects, fulfilling study tasks, producing samples of study materials, etc.
- developed skills for using electronic communications, searching information and using other Internet services for education, research and qualification.

Evidence for the success of the project in gaining the upper mentioned results are :

- evaluation marks and results of the trainees, demonstrated at examinations;
- products and materials, developed as a result from team (group) work and e-mail projects (see also Teaching materials);
- successful participation of the trainees in practical seminars and workshops;
- established links and contacts with students and colleagues from foreign schools and universities - useful exchange of information and ideas, collaboration, participation in mutual educational and research projects.

Cooperation between partners

During the third project year the already established and operative cooperation between partners was further developed and strengthened. Project team members collaborated successfully, did a lot of mutual work, permanently helped and supported each other in all the main aspects of the project activities - education (teaching and developing ICT modules, trailing, producing study materials, providing practical guidance, constancy, etc.) and management and popularization and dissemination of project ideas.

Collaboration and cooperation between the partners can be demonstrated through:

- permanent communication (electronic and other) concerning organizational and management issues related to accomplishment of the outcomes;
- decision making on project management issues, based upon discussions of different points of view;
- running mutual e-mail projects;
- collaborative development and enhancement of ICT modules and curricula;
- exchange of pedagogic approaches and procedures in teaching ICT, related to different stages and elements of the educational process - short visits to partner institutions within the country;
- collaborative preparation and presentation of posters, aimed at the advertising of project activities and outcomes at Tempus Open Days (regional and national levels);
- cooperative preparation of a Tempus CME project proposal (submitted in September 1997 and signed in March 1998) - "New approaches of ICT in teacher education", intended to continue, further develop and disseminate main Tempus ideas in the Higher Education in Bulgaria.

Teacher and Student Attitudes Toward Information Technology in Four Nations

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Abstract: This international panel compares teacher and student attitudes toward information technology in four nations: Korea, Mexico, The Netherlands, and the USA. 1998 data has been gathered using instrumentation in common for several two-nation or three-nation subsets among the four sites.

Types of Comparisons

Four categories of comparisons are presented:

1. Secondary Teacher Attitudes in -
   a. Mexico (n = 60) vs.
   b. Texas (n= 200) vs.
   c. The Netherlands (n = 27).

2. High School Student Attitudes in -
   a. Mexico (n = 600) vs.
   b. Texas (n = 1000).

3. University Faculty Attitudes in -
   a. Korea (n= 90) vs.
   b. Texas (n = 330).

4. Preservice Teacher (University Student) Attitudes in -
   a. Texas 4th year university students vs.
   b. Korea 1st year college students vs.
   c. Texas 1996 1st year university students.

Instrumentation

1998 data has been gathered in four nations using the following Likert/Semantic Differential instruments: Teachers' Attitudes Toward Computers Questionnaire (Christensen & Knezek, in press), Teacher's Attitudes Toward Information Technology Questionnaire (Knezek & Christensen, 1998), the Faculty Attitudes Toward Information Technology Questionnaire (Gilmore, 1998), and the Computer Attitude Questionnaire (Knezek & Christensen, 1996). Reliability for each of these instruments has been shown to be high. Each questionnaire was translated from English to the local native language in countries outside the USA.

Sampling

Procedures used to select the subject pool varied somewhat, by country. Mexico used a systematic sampling procedure to draw subjects from urban, suburban, and rural areas in three different states (Morales, Turcott, Campos & Lignan, 1998). U.S. data was broadly sampled across areas of low and high population density, predominately in the states of Texas and Louisiana (Knezek, Christensen & Arrowood, 1998; Eaton, Magoun, Owens & Smith, 1998). Data in the Netherlands was gathered from teachers taking part in network discussions on technology integration (Moonen, 1998). Korea data was gathered from faculty and students attending a university in Seoul.

Results

The long range goal of this project is to assess Information Technology (IT) trends within each nation and then compare trends among nations. Nevertheless, many differences between IT cultures in various nations are so large that translation bias or cultural rating bias could not be a reasonable explanation for the differences found. This first year look across cultures is believed to be especially useful for establishing an initial (baseline) frame of reference from which future comparisons can be made. Findings for individual projects are available online in Mexico (http://investigacion.ilce.edu.mx) and Texas (http://www.tcet.unt.edu).

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The NRW- Educational Server learn:line and the Corresponding Project for In-service Teacher Training

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Abstract: Two years ago the educational server learn:line of North Rhine Westfalia started two years ago at the State Institute of School and Further Education in Soest, Germany. We put into practise a special pedagocical concept and built u a platform for different types of schools– a platform for information, communication and cooperation among teachers as well as students who could work with the same material (on this server), on the same topics, on the same problem (from different points of view) in virtual workspaces.

In addition to this a program of in-service teacher training was started. Tutors help teachers to get familiar with new technologies, discover ways how teachers can use the internet to prepare their lessons and how classes can work with the internet. This in-service teacher training is meant to accompagny the development and evaluation of learn:line.

1. learn:line, the Educational Server and its Pedagogical Concept

Background and aims

Learning for life in the „information society" means to face many different specialized, inter-disciplinary or social problems.... So school has to take care of more than teaching factual knowledge and special information of each school subject. Teaching aims at lifelong learning as a perspective of beeing prepared in this changing world. Students have to be encouraged to continue on developping their network of cognitive concepts. By including the new possiblities of new media- especially telecommunication- we hope to improve the quality of working and learning in school and further education. We would like to support a more responsible, constructive and communicative learning in open learning situations where the learning individuuum could better contribute actively by drawing on his/her own experiences. We would like to initiate learning through exploration, communication and cooperation.

The educational server learn:line is a platfrom on the internet for information, communication and cooperation. We want to support (promote) possiblites, to get in contact with other people –outside national schoolsystem as well as abroad- to exchange experience, to work together in projects and to learn from each other. The latest academic research of learning processes has motivated us to create learning sitations that are not only linear structured but open, explorative, e.g. situations, in which learners have to play an active role. This will change the teacher's role, too- from an 'instructor' to a ‚learner enabler', someone who advises and accompagnies the individual's learning process.

New media may play an important role. One should not not forget that media competence is an educational condition for acting in a social and responsible way. The encrease of media competence is one of the most important aims. By working and using new and traditional media students will learn to use them in a creative, appropriate way, knowing the effects and limits of modern technology.

Work Areas –Characteristics of the NRW-Educational Server

Work areas relating to particular topics are characteristic to the NRW-Educational Server. They represent a kind of learning arrangement or provide an infrastructure for encouraging learning. According to our intention to learn and teach with meaningful and specialized contexts, each work area concentrates on a particular topic that is directly or indirectly related to schools, teaching or further

education. Each work area exists as an independent information and communication offer; it provides the relevant material while still encouraging the user to help to complete the material.

Each work area is divided into the following sections: a *media centre*, a *foyer* and a *noticeboard.*

In the *media centre* the user can find information, selected materials and lesson plans. Links to other sites will help to make other contribute to work on the topic. This could involve the use of texts or diagrams, files of an computer algebra system in math, but perhaps audio files, e.g. authentic documents for foreign language learning.

In the *foyer* interested parties can get the chance to present their own work related to the topic, results and experiences from a particular project.

The *noticeboard* is made available in every work area for questions, answers, suggestions and discussion.

Students can access the virtual *work room* easily by a browser. There they can work together on documents, exchange ideas or files of their work.

At the moment there are 50 work areas on the NRW-Educational Server. Each of them is not completely "finished" but open to further development.

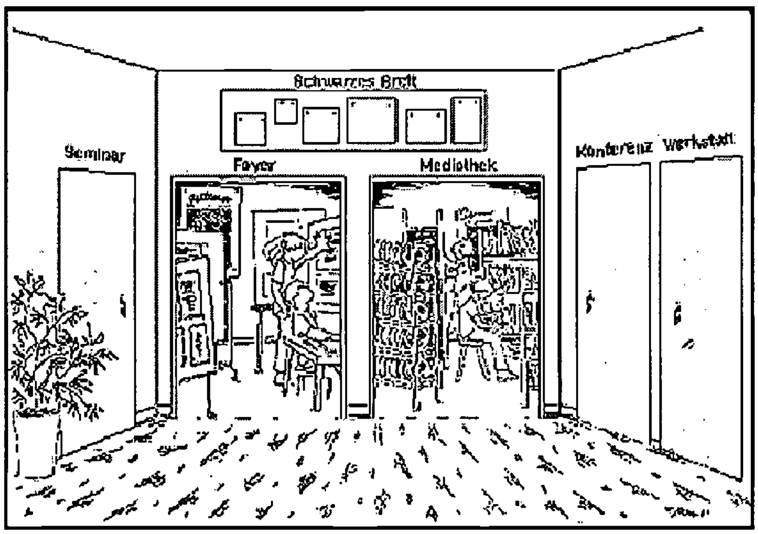

Figure 1: work area compared with an appartment hall that leads to different rooms

Besides the work areas learn:line opens various gateways to information, communication and cooperation. Suitably qualified and relevant sites already existing on the net are brought together and partly commented.

The „meeting point" (outside the work areas) is the virtual location where all educational institutions taking part in the pilot scheme "NRW-Schools on the net - worldwide understanding" as well as interested schools and other institutions can communicate with each other, inform others of the projects they intend embarking upon and exchange experiences and suggestions. For these purposes a database with information on schools and projects, a pinboard and an appointments calendar with details of competitions and other organised events are made available.

Persons in Charge on the Educational Server learn:line

The concept, contents and maintenance of the work areas are in the responsibility of the persons in charge. These may be one single person, a group or an institution. Most of them are teachers, with a high competence on this topic, who do their work voluntarily, without any reduction in working time in school and with any fee for this. The persons in charge are responsible for the contents of the media centre, try to enlarge it by new information and keep it actually. The contents of the other modules are normaly built up by interested users, who contribute to it, discuss and write down their experiences.

Entry to all Offers of the NRW-Educational Server – Different Points of View

There are different points of view and corresponding acesses to the work areas and other interesting sites:

- Via *„Fächer“* (subjects) you can chose different work areas available e.g. for foreign language learning, math, history, geography, german, physics, biology, economics. This entry corresponds to the traditional point of view by the subjects.
- Under *„Themen“* (topics) you will find work areas for interdisciplinary learning.
- Under the heading *„Anbieter/Institutionen“ (*providers/institutions) in learn:line more than 200 offers with special interest for teachers are acessable, e.g. newspapers online, museums or announcements of in-service teacher training.

2. Learning with New Media- a Work Area Especially for Teachers's Need

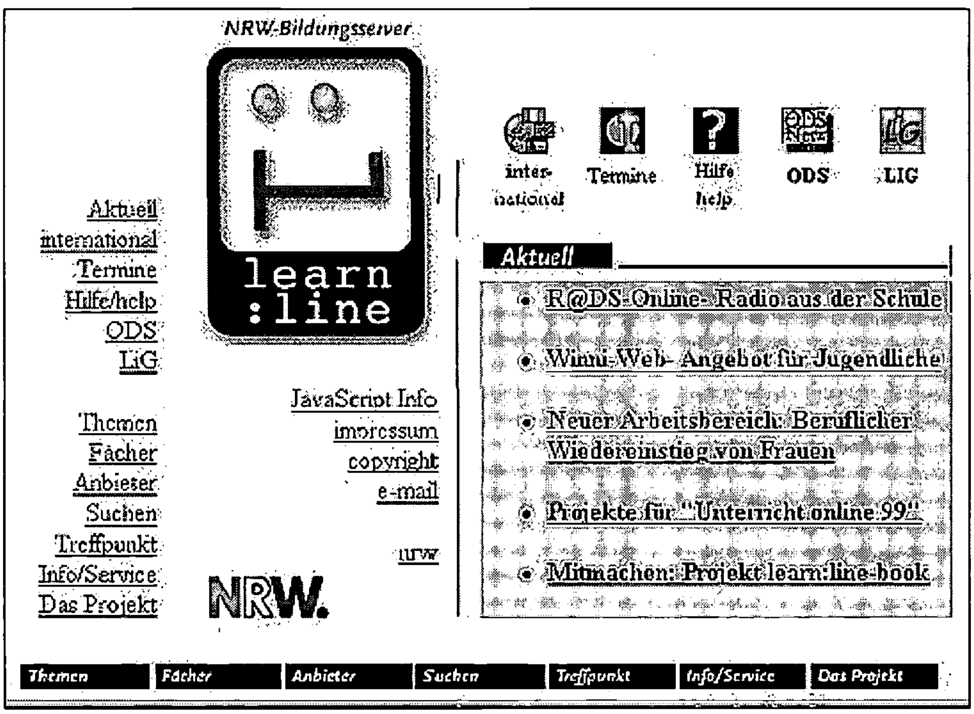

Figure 2 The learn:line-homepage (4.12.98)

From the homepage via *„Themen“* (topics) interested parties can gain access to the work aerea „Learning with New Media“. Teachers in particular can obtain informations about media for special subjects. They will find short descriptions of new media that are titeled to be exemplary- hat means media, that can mprove the quality of work and learning in the way mentioned above. Reports comparing similiar products and pointing out main differences are as well as available as ideas for its use in classroom and pointers to other work areas that use or discuss these media e.g. computational geometry.

The *foyer* of this work shows reports of classroom situations, results and student's work with some of these exemplary products.

http://www.learn-line.nrw.de/Themen/NeueMedien/

3. Fairytales - Märchen – A Bilingual Work Area Especially for the Pupil's Need

This work area exists in two versions- an english and a german one. On every webpage the visitor may switch to the other language version. The foyer of this work area is the main and most interesting part of this work area and should be a centre of creative writing – especially for fairytales.

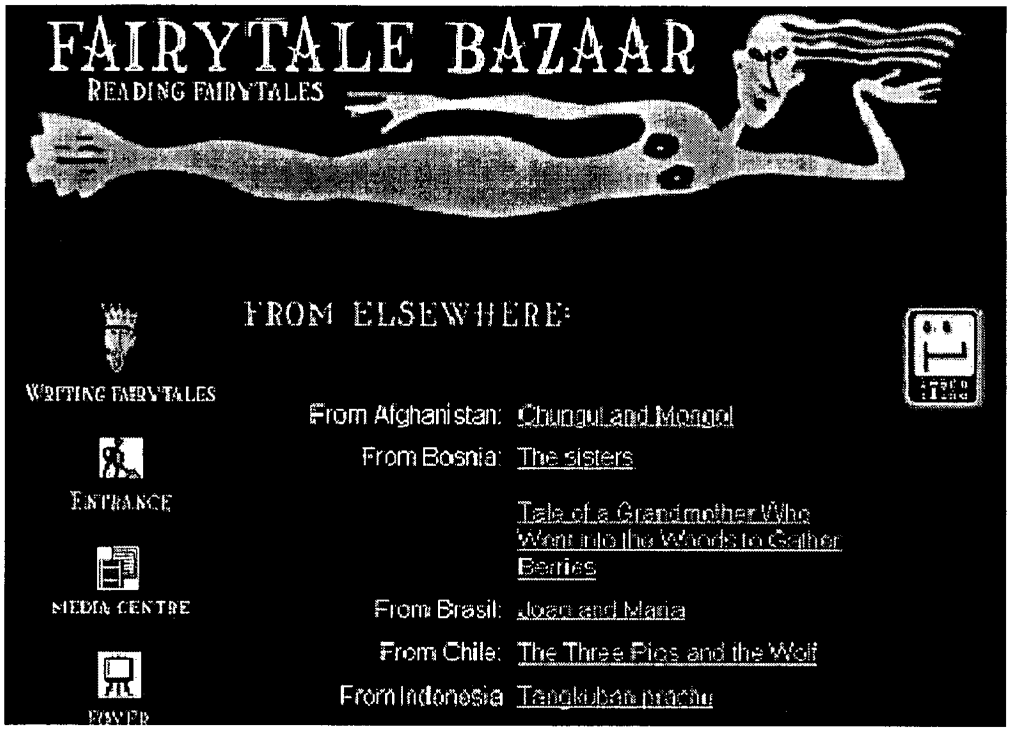

Figure 3 : The BAAZAR of the Work Area „Fairytales"

Fairytales could almost be the only component of literary tradition which is accessible and well-known to children today. At the same time fairy tales are stories that bring back memories from when they were very young. Children need fairy tales: they are emotionally charged and important for a child's development.

The building blocks and the form taken by fairytales are international - admittedly always new and different, yet often strangely familiar. Anyone who reads fairytales again at the age of ten or twelve may encounter some peculiar aspects in a familiar context and vice versa. So it's an appropriate way to introduce children in this part of literacy.

And here one possible cenario in school: 5 or 6 grade children are asked to talk about their experiences with fairytales – about whether and how they got to know fairytales (told from memory? Read to them? By whom? In what circumstances?...); whether and how they remember some fairytales. (Were there or are there any favourite stories? Can the children still tell one?) Does the tradition still exist anywhere in the world of public fairytale telling? Have fairytales told or read out in class; the teacher may ask the children to choose a fairytale that is as little known as possible and that is nice but not too long. (Particularly in classes consisting of children from different countries, there will be interesting things to be heard.) Even when listening to unknown texts, well-known and familiar aspects will recur. During this period some fairy tales from foreign countries in the foyer of this work area could be used, too.

If the pupils have access to computers, they can work on them as this by no means needs lengthy introduction. By reading fairytales their creativity will be stimulated too. Copying the written fairytales up on computer supports the reworking of texts with the ultimate target of a mistake-free, well-written and well laid out piece.

Also some texts from other countries can be found in the bazaar (foyer). A collection of texts that have been passed on to us by immigrants is desirable for many reasons. And one can think on many more activities that would not be possible without the internet. Many more other things can still be done with fairytales. You can, for example, produce a fairytale on the stage – perhaps as a shadow play with a narrator? This could involve the English, Art and Music departments working together; or you can think up a project (via email) in which the classroom becomes an oriental caravanserai, where the fairy story tellers all come together. Isn't intersting to getting to know the varity a special fairytales that are told in different cultures? Or comparing new one based on the same fairytale theme?
http://www.learn-line.nrw.de/Themen/Maerchen/foyer/foyer.htm

4. The Corresponding In-Service Teacher Training

To support teachers in trying out the new medium internet and its possiblities for teachers at home preparing lessons and especially in the classroom a group of teachers (about 200) has set up. The first year they helped the schools to connect the computers to a network and managed the access to the internet - sometimes rather difficult because of „old“ hardware.

By now most of the schools can work with the internet. The tutors of the in-service teacher training offer courses for different subjects. This ‚teacher on demand‘ can be invited by the members of a subject conference e.g. of English to work with the teachers and helps with planning internet projects or building up websites. Every tutor is specialized on one or two subjects for in-service teacher training.

5. First Evaluation of learn:line and Future Projects

Learn:line has officially been on the web since 17 th February 1997.

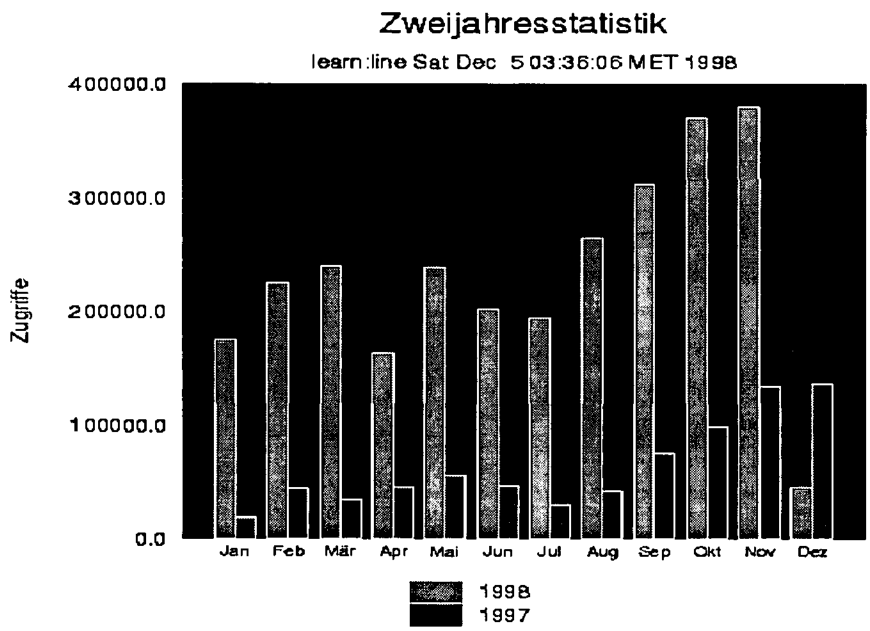

Figure 4 : Increase of Traffic on the Educational Server learn:line

Up to the start the learn:line project has extended with regards to the varying interests and topics of educational institutions. Table 1 shows, how many work areas belong to each educational topic.

number of work areas (areas under construction)					
foreign language	**12**	(2)	**mathematics**	**6**	(3)
german	**6**	(1)	**natural science**	**3**	(2)
social sciences	**8**	(3)	**media**	**4**	
vocationally orientated	**5**	(4)	**other**	**8**	(10)

table 1: number of work areas in main subject fields

The statistics show that the most visitited work areas are theses of foreign language, math and media. However, one thing is clear: no other medium for foreign language lesson can offer more opportunities like this for receiving up-to-date authentic texts for communication between genuine partners. The wide range of materials on the internet, the references to interesting entries and the stimulus given to pupils encouraging them to work actively and creatively on the learn:line work areas take away much of the burden of a teacher by providing for a classroom situation where the youngster work together in small groups. Learn:line wants to support those teachers who want to change their role and want to focus on the children and the individual‘s learning process.

In this way learn:line tries to devise a platform based on the latest academic resaerch on learning processes.

The future projects are to improve the possibilies for communication and cooperation so that participants could meet at the same time. The *seminar room* for example is planned to be chatting room, where students and teachers discuss questions and problems relating to the topic of the work area. In a module called *conference room* video conferences relating to the topic can take place.

If we succeed in teaching pupils as well as teachers how to use these new possiblities competently, we can contribute to a lifelong , meaningful learning.

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Acknoledgements:

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MATHEMATICS

The Development of a Data Bankof Mathematics Performance Tasks for All Students

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"The Development of an Electronic Data Bank ofPerformance Tasks in Mathematics for All Students" provided teachersand teacher education students in southeast Missouri with training increating mathematics performance tasks to prepare their students for the mathematics portion of the new MissouriAssessment Plan. Training involved instruction in generating mathematicsperformance tasks, using technology to enhance the tasks, methods to makethese tasks universally accessible to all students, and collaboration techniques between regular and specialeducation teachers. Participants were also presented with updatedinformation on the Missouri Assessment Plan and the new requirement thatMissouri students with disabilities must take this standardized assessment as outlined by IDEA. Tasks that weredeveloped, including activities, scoring guides, and techniques formodification of the activities, are posted at the following web site: http://cstl.semo.edu/Performance/.

Learning Styles To Increase Female Participation In Mathematics

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Abstract: *America 2000* is a project that places emphasis on national achievement of females in mathematics and science in order to increase the number of women in mathematics, engineering and science related careers. The meta-analysis, summary of recent studies of gender differences in quantitative tasks, of Freidman substantiates that it is not the female student, but rather the classroom and social structure that limits females active involvement and achievement in mathematics (Hanson, 1992)

Why research gender issues in mathematics?

Since the emergence of the United States, Americans have witnessed phenomenal changes. From 1776 to the present, America has undergone an evolution from an agrarian society to an industrialized society and on to an industrialized nation. These dramatic shifts and other manifestations of social reality can be defined and explained by key concepts, such as race, class, gender, age, and culture (Altbach & Lomotey, 1991). These dramatic shifts in our society have been the impetus for numerous changes in education. For instance, the role of science and technology in American society is currently undergoing dramatic change. The nation continues to be troubled by the apparent lack of mathematics achievement by females and by the lack of involvement of women in math and science related careers. While the gap between female and male achievement is finally decreasing, females still take fewer and less advanced math courses than males, and women are still poorly represented in careers requiring sophisticated mathematical knowledge (NSF, 1998). According to a report published by the National Science Foundation (1994), American society is becoming increasingly technology-oriented. The basic understanding of mathematics is essential for those who pursue careers in scientific and technical fields and for all people. This understanding can minimize a "....population that is ill-prepared to fulfill the needs of a technically competent work force or to exercise their full rights and responsibilities of citizenship in a modern democracy" (National Science Foundation, 1994, p.1). Therefore, if our nation is to remain economically viable during the next decade and beyond, it is imperative that we begin to examine those key concepts, specifically gender equity, that have traditionally endured educational, political, and economical neglect.

Research discloses that the educational system is not meeting the needs of girls. Girls and boys enter the educational arena roughly equal in measured ability. However, twelve years later, girls have fallen behind their male counterpart in key areas such as higher-level mathematics and measures of self-esteem (AAUW Report, 1990). There is widespread agreement among researchers that we must respond to this challenge, examining gender achievement, in order to ensure that every individual has a full range of opportunities for personal fulfillment and participation in educational institutions and in our society. A crucial step toward correcting the educational inequities is to identify and examine them publicly. Further research as well as current findings should be disseminated to expose and discourage the use of myths that do not support the concept of differences in gender learning styles.

In 1984, Johnson stated that for the past twenty-five years male high school graduates on the average outperform females in mathematics (. Strong evidence of a sex difference in problem solving was first shown in studies conducted in the 1950s by students of Donald Taylor, teacher and researcher at Stanford and Yale (Johnson, 1984). These studies were inconclusive as to the causes, but results indicated that boys usually perform better than girls on tests involving mathematical reasoning. Supporting studies have found that girls do equally as well as, or better than, boys on computation problems; whereas, boys excel on story problems or problems requiring spatial visualization (Marshall 1984; Peterson & Fennema, 1985; Fennema & Sherman, 1977; Johnson, 1984; Pattison & Grieve, 1984; Reyes & Padilla, 1985; ACT Report, 1998). Also, two large assessment programs, the National Assessment of Educational Progress and the California Assessment Program, note that these differences in mathematics achievement exist (Marshall, 1984).

Later, Peterson and Fennema (1985) reported that male superiority is detectable in late elementary years and increases throughout high school. "This pattern, which favors boys, is recurrent across countries and over time" (Pallas & Alexander 1983, p. 166). High school males typically score higher than high school females on the SAT-M. In 1985 the mean SAT-M score was 499 for men and 452 for women (Aiken, 1987). In a study of 1000 college students, Johnson (1984) came to the "....definite conclusion that a pronounced male advantage in problem solving was found. Its cause remains unclear" (p. 1360). Now into the 90s with slightly over half the total population in this country female, the need to increase the number of women in mathematics and science studies is apparent after reviewing data.

While strides toward increasing the number of females in mathematics and science have been made, there are still areas in need of improvement. Figure 1 indicates the number of Bachelor, Master, and Doctoral degree conferrals by gender in physical sciences, mathematics, and life sciences for the year 1989 in the United States.

Figure 1

Number of Bachelor, Masters, and Doctoral degree conferrals by gender in 1989

	BACHELORS		MASTERS		DOCTORATE	
	Male	Female	Male	Female	Male	Female
Physical Sciences	9,777	4,371	2,836	1,040	2,843	651
Mathematics	8,333	7,106	2,061	1,370	734	158
Life Sciences	28,787	23,825	8,430	3,581	3,657	1,852

SOURCE: *Science Resources Studies Division, National Science Foundation*

The findings in Figure 1 indicate a wide disparity by gender in the number of graduates completing degrees in mathematics or the sciences. The data also reveals males outnumber females almost four to one in physical science and mathematics at the doctoral level. Also, analysis of the data in Figure 1 indicates the higher the degree the greater the achievement gap between females and males in all three disciplines.

Since 1980 the number of bachelor degrees in physical science has decreased for male graduates and remained about the same for females. While the number of bachelor degrees in mathematics has increased for both males and females, a decrease in life science degrees for both males and females has occurred. Finally, for the years 1980 to 1989 there was a large gap by gender in the number of graduates completing degrees in mathematics or science (National Science Board, 1991).

Mathematics and Gender Differences

The mainstream model of education neglects female students because their learning styles do not coincide with individual and competitive learning environments. Mathematics language, its discourse mode, and classroom dynamics are opposite to the way females are taught to interact and communicate (Hanson, 1992). Independence is a quality that society discourages in females but promote in males. Consequently, school girls tend to be more dependent on others instead of being self-reliant (Mann, 1994). Women feel uncomfortable and excluded in a classroom structure that is designed to foster independent, non-collaborative thinking. Females prefer to use a conversational style format in classrooms that foster group consensus and builds ideas on top of each other where the interrelationship of thoughts and actions is paramount (Schwartz, Hanson, 1992). In addition, there is a continuous national concern about the apparent lack of mathematics achievement by females and by the lack of involvement of women in math and science related careers. Therefore, this study examined instructional strategies that utilizes learning style theories that will promote females participation in areas of mathematics, science and technology.

In 1992, the American Association of University Women (AAUW) published an article How Schools Shortchange Girls. This report highlighted all aspects of education concerning the disparity of educational experiences between males and females. One critical component of this examination focused on classroom interactions - teacher/student and student/student. Through all levels of education, preschool to university, the study found that males demand and receive more attention from teachers than females - particularly true for mathematics and science classes. Consequently, this article prompted considerable attention towards discourse styles in classrooms that overlook

females. Whitney Ransom, a participant in the National Coalition of Girls' Schools, believes that poor retention rates for women in math and science are directly related to inhospitable teaching techniques and classroom environment (Mann, 1994). *America 2000* is another project that places emphasis on national achievement of females in math and science in order to increase the number of women in mathematics and science related careers. Researchers of this project (*America 2000*) performed an international study using twelfth grade females from fifteen countries. The results indicated that **all** subjects except in three countries - Thailand, British-Columbia (Canada province), and England - females' mathematical achievement levels were lower than males (Hanson, 1992). In addition, recent studies of gender differences in quantitative tasks substantiates that it is not the female student, but rather the classroom and social structure that limits females' active involvement and achievement in mathematics (Hanson, 1992).

Nationally, there is a poor retention rate of women, especially African American, in mathematics and science. The National Coalition of Girls' Schools believes that this poor retention is due to inhospitable teaching techniques and classroom environment for women (Mann, 1994). The " typical classroom" model is individualized and non-collaborative instructions (Hanson, 1992). However, most females are field-dependent learners which means they need a classroom that would promote collaboration and cooperative learning.(White, 1992). According to White (1992), field-dependent learners enjoy working with others to achieve a common goal. In addition, field-dependency directly relates to cooperative learning (Hanson, 1992; Farivar, 1992).

Cooperative Learning and Female Achievement in Mathematics

To close the gap between males and females achievement in mathematics, efforts must be intensified to see that females receive equal, effective education as males (Hanson, 1992). It is imperative that discourse in mathematics classrooms be change in order for females to have greater achievement in mathematics. A classroom dynamic that addresses the issues of discourse and mathematics content will be favorable to the success of females. Borasi asked the question that will begin the process of solving females under-representation and under-achievement in mathematics - "How can school mathematics be changed in order to become more appealing to women and better accommodate their thinking and learning style?" (Hanson, 1992). Hanson (1992) suggested the answer to this question by stating that educators should "Involve students as active learners and involve them in many hands-on activities,... discover any academic deficiencies girls may have,... correct them in ways that encourage them to continue mathematics through cooperative learning sessions that incorporate support for becoming autonomous" (p. 5). Cooperative learning classrooms have been found to be superior to individualistic and competitive classrooms in promoting individual achievement, positive social relationships, and higher self-esteem (Nidhi, 1991). In a gender-related study involving Lego TC, middle school girls' interest and achievement increased when groups were structured to integrate girls and boys into *team* projects (Hanson, 1992). Cooperative learning is an instructional methodology in which students work together in small usually heterogeneous groups on a single task or towards a single goal which often results with a group reward (Farivar, 1992). There are several types of small group methods. They include: Group Investigation (GI), Co-op Finding Out/Descubrimiento, The Structural Approach, Learning Together (Johnson's' Method), Team Assisted Individualization (TAI), Cooperative Integrated Reading and Composition (CIRC), Student Teams—Achievement Division (STAD), Teams-Games-Tournament (TGT), and Jigsaw II. However, for the purpose of this study, it is only necessary to define Learning Together (Johnsons' Method). This strategy emphasizes positive interdependence, direct teaching of interpersonal and group skills, face to face interaction, and individual accountability. All students must perceive in order for a group to be successful - "We sink or swim together" (Johnsons, 1994; Thousand, 1994; Slavin, 1986). Research shows that the enjoyment of mathematics activities, the level of engagement or time on task increases, and an overall positive affective reaction towards cooperative mathematics activities (Bono 1991). Research shows that girls learn better when they work together to solve a problem (Mann, 1994). Gilligan and Belenky stated that females are commonly known to utilize a "connectivist" mode of thinking (Hanson, 1992).

Cooperative learning enhances academic achievement by having students work in teams to clarify concepts and solve problems (Markstein, Posner, 1991). Through numerous studies, it has been determined that girls prefer more student centered and cooperative classrooms (Moffat, 1992). A 1977 study researched by McMillan concluded that women in small groups produced more model constructions (Hanson, 1992). Also, the study of two females (one white, one black) by Buno (1991) compared the subjects attitudes toward individual, competitive and cooperative learning. Findings indicated that the two subjects had more positive attitudes about mathematics in a cooperative setting.

Impact of Technology and Cooperative Learning with Females

To close the gap between males and females achievement in mathematics, efforts must be intensified to see that females receive equal, effective education as males (Hanson, 1992). It is imperative that discourse in mathematics classrooms be change in order for females to have greater achievement in mathematics. If our students are going to be competitive during the up coming century within a complex society where mathematics, science, and technology play an important role, it will be imperative for them to improve their problem-solving skills and mathematics, science, and technology literacy. Borasi asked the question that will begin the process of solving females under-representation and under-achievement in mathematics, "How can school mathematics be changed in order to become more appealing to women and better accommodate their thinking and learning style?" (Hanson, 1992). Integrating computer applications provide opportunities to create real-life situations, hands-on opportunities, and provides equitable educational opportunities for the field-dependent learner. Thus, the purpose of this study was to examine instructional strategies that would promote African American females' class participation using cooperative learning and technology.

Analysis of Data

Study

The researcher implemented cooperative learning as an instructional methodology in which pre-service students in a methods course worked together in small, usually heterogeneous groups on a single task or towards a single goal in the computer laboratory. As previously stated, there are several types of small group methods which include: Group Investigation (GI), Co-op, Finding Out/Descubrimiento, The Structural Approach, Learning Together (Johnsons' Method), Team Assisted Individualization (TAI), Cooperative Integrated Reading and Composition (CIRC), Student Teams--Achievement Division (STAD), Teams-Games-Tournament (TGT), and Jigsaw II. However, for the purpose of this study, it is only necessary to define Learning Together (Johnsons' Method). This strategy emphasizes positive interdependence, direct teaching of interpersonal and group skills, face to face interaction, and individual accountability. All students must perceive in order for a group to be successful - "We sink or swim together" (Johnsons, 1994; Thousand, 1994; Slavin, 1986). Students were introduced to the computer using the Learning Together method. Students enrolled in this methods course are given e-mail addresses and they are required to join various list-serves. Students are not required to interact with the professor nor each other, but they are required to develop an address book with e-mail addresses of their classmates. Communication with each other and the teacher was optional.

Data Organization

The number of mathematics education majors at Mississippi State University is small; therefore, the Secondary Mathematics Methods Course is taught during the fall semesters. During the 1995 semester (when this study began), there were thirteen students enrolled in the methods course and there were only fourteen students enrolled in the course during the 1998 fall semester. The total number of subjects at the completion of study was 49 (1995-1998 mathematics education majors enrolled in the methods course). Each subject was assigned a computer and unlimited use of the computer along with a Mississippi State University (MSU) account.

Results

The preliminary results of this study showed that female pre-service teachers interacted more when permitted to assist in the structuring of the lessons; incorporated learning resources (manipulatives and computer) at their respective schools more than male pre-service teachers. In addition. females used some type of manipulative with all lesson plans, while the males used the traditional lecture method. Students were required to submit assignments through e-mail and encouraged to join Internet organizations, i.e., PRESTO, and to correspond with each other, the teacher, and other users of the Internet. The study also showed that females interacted (e-mail) with the professor more that the other students enrolled in the methods course. Figures 2 and 3 illustrates the interaction of mathematics students with the professor via e-mail. Students were required to interact a certain number of times with the professor; however, this illustration shows that forty-three percent of African American females interacted with the professor. Also, thirty-nine percent of European American females exceeded the required amount of Internet communication. The study also revealed that 40 percent of the males met minimum

requirements (course work); whereas, 88 percent of the females exceeded the minimum requirements and maintained frequent correspondence with their peers, teacher and Internet organizations.

Figure 1

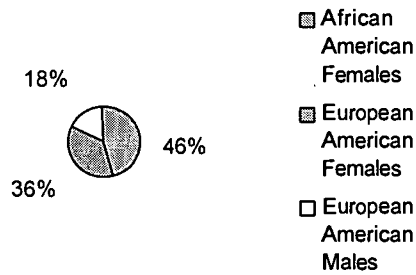
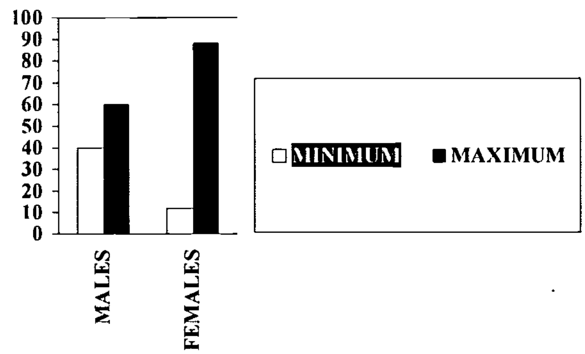


Figure 2



Implications

Despite the fact that issues surrounding the education of females within various ethnic groups in the United States have been highly controversial and emotionally charged for almost twenty years, there still appears to be little consensus among policy-makers and educators about what organizational and educational programs, teaching, and hiring practices are appropriate. Emphasis must be placed on the importance of increasing the number of females in mathematics, science, and technological areas that are underrepresented by various ethnic groups, specifically African Americans.

Applications

The Civil Rights and women's movements ushered in policies that addressed racial and sexual inequalities and harassment following much public fear and misunderstanding. Therefore, the planning implementation of programs that promote the acceptance and respect of diversity will continue to be issues facing educators in the twenty-first century. Therefore, the results can lead to further studies of females and males in mathematics, science and technology areas. Since this study was successful, educators may implement cooperative learning using technology as a major and permanent instruction of mathematics. As time progress, other educators may become interested in using the cooperative learning method. To meet the demand of the educators, the educational institutions would provide the necessary training.

As the nation becomes increasingly aware of the need to enlarge its pool of mathematicians, scientist, and technologists, attention should target African American females. They represent an underdeveloped resource. The most rapidly growing population sector in the United State today is that of the diverse racial and ethnic groups. In order to maintain the nation's human resource needs in all educational areas, it will be imperative to identify and cultivate at an earlier age.

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Math and Science Software: What Do Experienced Users Recommend for Novices?

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Technology staff development for math and science teachers has been a subject of interest for more than a decade. As reported in Collier (1996), the literature indicates rapid and exciting advances in math-science curriculum software over the last decade emphasizing inquiry-centered, process-oriented learning. Many new software products, designed in line with NCTM and AAAS standards, have emerged after years of product development and testing and are now available on standard platforms for schools. The literature also indicates that two schools of thought exist concerning what technology training should be provided for math-science teachers: one approach focused on math-science curriculum software; one focused on general tools that are valuable for all educators. Math-science-specific technology training has resulted in early application of computers in instruction for novices and increased use of technology in math and science classrooms for experienced users. Such training has focused on software that is well matched to curriculum, and participants have been exclusively math and science teachers. In those cases where tools, such as integrated Works packages (for example, Claris Works and Microsoft Works), were the software of choice, they have been approached from a curriculum focus.

Characteristics of Successful Technology Training

In general, the staff development literature offers the following the characteristics of a good training program for technology skill development and application in instruction:

- Training is on-going (Kinnaman 1993)
- Training is hands-on with expectations for application and feedback (Davis 1993; OTA 1995)
- Training is accompanied by modeling and demonstration (Joyce & Showers 1995 OTA; 1995)
- Training is backed by knowledgeable support and coaching (Beasley & Sutton 1993; Joyce & Showers 1995)
- Training is done collaboratively, preferably on-site, with other teachers at the same grade level or subject (Kinnaman 1993)
- Training focuses on classroom use, with attention to issues of pedagogy (Joyce & Showers 1995; OTA 1995)
- Training is geared to specific needs, which change as the technology changes, and which should be driven by the curriculum (Franklin & Strudler 1990; Loucks-Horsley & Stiegelbauer 1991; Joyce & Showers 1995)

In summary, it is thought that, in successful technology training for math-science teachers, teachers:

- see demonstrations of software
- investigate software in the context of their curriculum and their students' learning needs
- prepare lessons and activities using technology
- implement computer-based activities in the classroom
- receive coaching and feedback

The question remains: what types of software should be the focus of initial training, designed to get classroom teachers using computers in instruction in a way that is meaningful for the secondary math and science curriculum? Sparks & Loucks-Horsley (1989) advocate having participants get involved in the needs assessment and selection of content. The study reported here took the approach that teachers can act as advisors on training content. Those who were not currently users of technology were also asked to participate so that their expectations for technology training could be better understood.

A study with fifteen high schools in northeastern Massachusetts was designed to measure secondary math-science teachers' perceptions of the relevance of various types of software to math-science curriculum and associated training needs. Much of the data regarding the relevance of software to the math/science curriculum was reported in Collier (1996). This paper looks in greater depth at those teachers who are using computers in instruction in a manner consistent with standards for technology integration. It also looks at the relative strength of the technology programs in the responding schools. Finally, it discusses the recommendations by those computer-using math and science teachers for initial training for their colleagues who are computer novices.

The term "training" was selected for this study because it was the prevailing mode of staff development for computer integration in the geographic area in which the study was conducted. Colleges, universities, and educational service providers offered a variety of "training" to the region, including graduate courses, workshops for educators, summer institutes, and "short courses" or "classes" that awarded Professional Development Points (PDPs) for in-service teachers. In designing a survey instrument for the study, it was felt that not all participants were familiar with a variety of staff development models, but all were familiar with the term "training." The reader should not infer that training is recommended as the optimal mode of staff development for technology integration; rather, the focus here is on the content of staff development, specifically, which software should be integrated in introductory training.

The study asked math and science teachers to consider the broad range of software that might be made available to them in introductory training. Teachers were asked to assign a priority to each type of software for inclusion in an introductory training program for computer novices who could be expected to apply instructional technology in the math or science classroom as a result of the training.

Survey Instrument

Teachers were chosen as the population for this study, rather than technology directors or computer coordinators, because teachers are the ones expected to use computers in instruction. The specific population for this study were the high school (grades 9-12) math and science teachers from the Northeast Massachusetts Region of PALMS, or Partnerships Advancing Learning in Math and Science. The sample for this study was the complete population-- that is, all high school math and science teachers in the fifteen-school region.

The study used a survey instrument (a self-administered questionnaire) to query high school math and science teachers in regard to their perception of the relative importance of various types of software for instructional use and for topics for technology training. To enhance reliability, the instrument was based on a "Teacher Technology Survey" used by Merrimack Education Center with about one dozen schools. Since teachers were expected to be unfamiliar with some items on the survey, instructions told them to leave blank any items that they did not know. To provide consistent measures, the questions had a predetermined list of acceptable responses. Response categories and instructions were revised based on two field tests The majority of questions used a Likert Scale, and the scales were consistent: high-to-low, left-to-right.

Steps were taken to guard against subjective response. Compound questions were avoided throughout. The final question concerning instructional practices was only completed by teachers who used computers in instruction. The question was formatted for Yes/No response and did not make or call for subjective judgment about such divergent uses of computers as "educational games," "drill and practice," or "collaborative problem solving." Respondents were required to consider each item and indicate use or non-use explicitly.

The data was analyzed to construct a framework reflecting math-science teachers' perceptions of the relative importance of types of software for instructional use and a related framework of software topics for inclusion in introductory training. (Collier, 1996)

Descriptive statistics were applied to the data to determine range, mean, median, mode, standard deviation, and variance. Measures of central tendency were used to indicate averages for various indices for each group of respondents, in regard to the importance of the types of software for math-science teachers and the priority for inclusion in introductory training. Since the prerequisites were met, analysis of variance was used to measure the

difference in response between standards-aligned users and others in regard to importance of each type of software for instructional use and for inclusion in introductory training.

Computer-using respondents were identified as to whether or not their use of computers addressed NCTM and AAAS standards and Massachusetts Curriculum Frameworks recommendations for instructional technology. The instructional practices included in the survey ranged from drill and practice to several that are aligned with standards:

- Calculation
- Record measurements
- Manipulate data with a spreadsheet or database
- Simulate a system or phenomenon
- Collaborative problem-solving
- Inquiry ("What if...?" thinking)
- Mathematical modeling
- Exchange data with students in other schools

The dependent variables in the study were the perceived importance of types of software for instructional use and their priority in introductory training. Independent variables were the teacher's self-reported expertise with computers, their instructional practices with technology, and background matters, consisting of the following:

- Years of experience with computers
- Years of experience with computers in instruction
- Years of experience teaching
- Subjects taught
- Grade levels taught

Those teachers who reported using computers in instruction were also asked to indicate how they used computers in instruction, from a list of fifteen possible uses, including the standards-related practices listed above.

Results of the Survey

The survey instrument was distributed to representatives of the fifteen Northeast PALMS schools during Leadership Team meetings. The contacts agreed to administer the questionnaires to math and science high school teachers in their districts during regular Math and Science Department meetings during the next six weeks. Of the fifteen schools, eleven (73%) returned their questionnaires within the agreed timeframe. In all but one case, schools returned questionnaires from both the math and science department meetings. The single exception reported being unable to use department meeting time to administer the survey and, instead, asked individual teachers to complete the questionnaire and return it through interdepartmental mail; this school returned questionnaires from approximately 80% of the math department and 30% of the science department. The total number of respondents (n=172) from the eleven schools represented 84% of the math and science teachers in these schools (n=205) and 60% of the total population in the fifteen schools (n=288).

Usage by School and Relationship of District-wide Technology Plan

Table 1 (Tab. 1) shows the number of high school, math and science teachers for each school, followed by the number of respondents, the percentage of teachers responding from that school, and the percentage of respondents who report using computers in instruction in ways recommended by standards bodies such as NCTM and AAAS.

School (by size)	# Teachers	# Responding	# Using in Instruction
1	8	8	8
2	11	11	9
3	12	12	4
4	14	14	7
5	15	14	9
6	16	14	6

7	17	15	9
8	23	17	10
9	24	23	11
10	27	25	12
11	38	19	12
Total	205	172 (84%)	97 (56%)

Table 1: Number of Respondents per School and Those Using Computers in Instruction

Informal data sources, including district technology plans and discussions with department heads and district administrators, gives some insight into the role of comprehensive technology programs in classroom usage. Of the eleven schools, six reported usage rates above the average of 56% (see Table 1). The two schools with the highest usage were the two smallest schools, each of which had a comprehensive district-wide technology plan and knowledgeable support staff. One school with a low usage rate had a comprehensive plan that called for equipping the elementary schools first and the high school last, which may account for the low usage rate at the high school level. Of the six schools with usage above the average, three had established technology programs, backed by a comprehensive, district-wide technology plan, while the other three were actively engaged in district-wide technology planning at the time of the survey. This area of investigation bears further study.

Characteristics of non-respondents

Fifteen schools were asked to participate in the study, while only eleven actually responded to the survey. From conversations and interactions with non-participating districts, the following were the reasons for non-participation:

- in one case, departmental meetings were not held during the survey period, and the contact person was immersed in budgeting activities during the same time
- one school has a history of animosity with the sponsoring organization
- two contacts who committed were unable to administer the survey for unknown reasons

The first two of the four non-participating schools are known to make use of math-science curriculum software. One of these two districts makes use of graphing software and interactive physics software in a nationally-publicized interdisciplinary unit (Mosto & Nordengren, 1995). The second school is aggressively building its capacity to use microcomputer-based laboratory software and probes with its science program.

The other two non-participating schools use technology to some degree. Conversations and interactions with individuals at these schools suggest that the level of expertise among the high school math-science teachers is similar to other schools who participated in the survey. One of the schools is actively working to integrate technology with math-science instruction, while the other follows a computer-literacy approach to technology (that is, students learn to use traditional software tools as a separate curriculum strand).

Levels of Experience of the Sample Respondents

Teachers who report teaching math comprise 63% (n=109) of the sample; those teaching science comprise 51% (n=87). Note that in all but one school, one or more teachers reported teaching both math and science. With few exceptions, teachers responding to the survey instrument reported that they teach or have taught at multiple grade levels, with approximately 85% reporting experience at each grade level 9-12.

Those who have been teaching more than 10 years represent 78% of the sample. Another 7% report teaching 7-10 years, 5% report teaching 4-6 years; and 10% report teaching 1-3 years.

Overall, teachers responding to the survey reported greater familiarity with computers than expected. From informal discussion with teachers, it was anticipated that 50-75% of the population would report computer literacy, mainly experience with traditional tools (word processing, database, spreadsheet, drawing, and electronic mail) and that only 10-20% of the population would report using instructional technology in line with standards. In fact, the number of math-science teachers who report using computers in instruction is greater than 50% of respondents. Even teachers not using computers in instruction report that they use computers for other purposes, with the exception of 10 respondents (6% of respondents), who report that they do not use computers for any purpose.

A surprisingly high percentage (56%, n=97) of teachers responding to the survey report that they are already using computers in instruction in a manner consistent with recommendations by standards bodies, such as NCTM and AAAS. Those practices included

- calculation (33%)
- using spreadsheets/graphics to manipulate/visualize data (31%)
- simulation of scientific phenomena (21%)
- inquiry (20%)
- microcomputer-based laboratory experimentation (16%)
- mathematical and scientific problem solving (15%)
- mathematical modeling (15%)
- network science (9%)

Further analysis of usage data indicates that veteran teachers (those with more than ten years of teaching experience) are as likely as newer teachers to use technology in the classroom in a manner consistent with standards and curriculum frameworks. Table 2 (Tab. 2) shows the distribution of users at each level of teaching experience, with regard to their usage of computers in instruction.

Years of teaching experience	Using for instruction, aligned with standards	Not using for instruction	Using but not aligned with standards
1-3 years	9	7	1
4-6 years	3	5	0
7-10 years	8	3	1
>10 years	77	51	7
Totals	97 (56%)	66	9

Table2: Distribution of Years Teaching vs. Usage in Instruction Aligned with Standards and Frameworks

Of those respondents with less than ten years experience, 54% reported using computers in instruction in a manner consistent with standards and curriculum frameworks, compared with 57% of those with more than ten years experience. Overall, 56% reported using computers in instruction in a manner consistent with standards and curriculum frameworks. Given the small numbers of respondents in early years of teaching experience, the study did not look for significance in these differences.

Priorities for Initial Software Training for Math-Science Curriculum and Instruction

Teachers were asked in the second section of the survey to indicate their priorities for initial training--that is, training for computer novices to prepare them to use computers in instruction—relative to thirteen items. It was expected that a different set of priorities would emerge for those already using computers in instruction, perhaps aligned with their current level of expertise, and those not using computers in instruction, perhaps aligned with traditional software tools (word processing, database, spreadsheet, drawing, and communications). However, there were no statistically significant differences in response between instructional computer-users and non-users. Respondents in both groups indicated they were in agreement on a set of priorities which was different from either set of expectations. Their priorities for technology training, as measured by the survey, are aligned with instructional computer-users' perceptions of what software is most relevant to math-science curriculum. (Collier, 1996)

Table 3 (Tab. 3) indicates the relative priorities for the four indices of software for each group of respondents. Mean scores are based on a scale of 1 to 3, as follows:

3 - High Priority — The software is essential for the computer novice in preparing for instructional use of computers. Study of this software must be included in introductory training.

2 - Medium Priority — The software might be used by the computer novice for classroom/lab instructional use. Study of this software might be included in introductory training.

1 - Low Priority — The software probably should not be included in introductory training (for example, it represents an advanced topic).

Software Index	Instructional Users	Non-Users	Mean Difference	F
Data Manipulation Tools	2.55	2.46	.09	.46
Math-Science Curriculum Software	2.43	2.46	.03	1.85
Publishing Tools	2.23	2.16	.07	.95
Programming/ Authoring	1.76	1.72	.04	.36

Table 3: Comparison of Instructional Users vs. Non-Users Concerning Priorities for Training

ANOVA was performed for each index. No significant difference was found between users and non-users for any of the 4 indices.

Data Manipulation Tools include spreadsheets, charting/graphics, and databases. Teachers currently using computers in instruction assign higher priority to training with Data Manipulation Tools (mean=2.55) than with Math-Science Curriculum Software (mean=2.31). Teachers not currently using computers in instruction assign equal priority (mean=2.46) to training with Data Manipulation Tools and Math-Science Curriculum Software. The two groups are not significantly different, in a statistical sense, in their responses on either index.

Math-Science Curriculum Software is perceived as second in importance for training to prepare novices for instructional use of computers. Additional analysis was done to determine whether math teachers using computers in instruction had a different set of priorities from science teachers using computers in instruction, in regard to training with Math-Science Curriculum Software. The study was not specifically designed to elicit such differences; all teachers were asked to respond for both math and science. However, a ranking of individual items within the Math-Science Curriculum Software index indicates that the top priorities are different by discipline. Table 4 (Tab. 4) indicates math teachers' emphasis on modeling software and science teachers' emphasis on microcomputer-based laboratories.

Math	Mean (StDev)	Science	Mean(StDev)
Modeling	2.64 (.51)	**Problem Solving**	2.63 (.48)
Problem Solving	2.63 (.55)	**Simulation**	2.43 (.55)
Simulation	2.31 (.63)	**Microcomputer-based Lab**	2.40 (.69)

Table 4: Priorities for Math vs. Science Teachers for Training with Math-Science Curriculum Software

The apparent disagreement between math and science teachers concerning specific priorities for training with Math-Science Curriculum Software is understandable. As teachers become more familiar with Math-Science Curriculum Software, the importance of Math-Science Curriculum Software as an index may rise and there may be more discernment among respondents concerning which software should receive priority. Future research in this area should be designed to elicit differences by discipline.

Conclusions

From the responses by teachers participating in the survey, it appears that an initial training program that features

- spreadsheet and graphics from the Data Manipulation Tools index,
- one discipline-specific Math-Science Curriculum Software package, and
- word processing as a fundamental tool for publishing and communication

is the preferred approach to preparing computer novices to use computers in instruction. Math and science teachers who use computers in instruction report different priorities among individual examples of Math-Science Curriculum Software by discipline. This is understandable, since Math-Science Curriculum Software is discipline specific at the

secondary level. Veteran teachers were as likely as new teachers to use technology in instruction in a manner consistent with recommendations from standards bodies and curriculum frameworks. The presence of a district-wide, comprehensive technology plan may indicate higher levels of standards-aligned usage of computers in instruction, but further study is needed in this area.

Abstract: This paper presents findings of a survey given in 15 school districts, all members of the Partnerships Advancing Learning in Math and Science (PALMS) in Massachusetts, asking secondary math and science teachers about their use of computers in instruction. The findings show that veteran teachers are as likely as beginning teachers to have and apply computer expertise in the classroom and that instructional use of computers is not confined to schools with extensive technology programs. The math and science teachers surveyed here recommend that initial training focus on spreadsheets and graphing/charting software and selected titles specific to the math or science.

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Constructivism and SSDMA as basis for technology use in mathematics teacher education.

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Abstract: This paper further investigates two models of teaching/learning mathematics that have proven effective using enhanced instructional technology. The first, cognitive constructivism is based upon the work of Cornu and Dubinsky (1989) and Connell (1995) and should be familiar to the SITE audience from previous papers and editorial comments. The second, Step by Step Development of Mental Activities (SSDMA), as interpreted by Bouniaev, comes from the Russian psychological theories of Galperin & Talizyna (1979). Upon a close examination of these two theoretical backgrounds some fascinating similarities emerge – when viewed from mathematics education. Of particular interest these similarities do not emerge until technology is brought into the picture. Technology will be shown to play an integral role in facilitating the ongoing construction of meaning within both theories.

Introduction

During the last decade psychological theories initially developed using experimental data not connected with advanced mathematics are increasingly applied to this highly complex area. Among such theories is that of constructivism going back to the works of J. Piaget (Piaget 1972). At the same time, specially in view of large scale introduction of computers, activity theories going back to works of L.S.Vygotsky (Vygotsky 1978) and A.N.Leontiev (Leontiev 1972, 1979) have seen a new development. Among them is the theory of stage-by-stage development of mental actions (further on referred to as SSDMA theory).

Using M. Connell's (Connell 1993) case study where constructivist theory was successfully applied for math instruction we suggested a strategy proceeding from the SSDMA theory (Connell & Bouniaev 1997). Despite the fact that activity theories belong to sociocultural psychological theories and as a rule are viewed as opposing to constructivism (see, Connell & Abramovich 1999), recommendations for teaching and learning strategies that we came to are very similar to the strategy that was developed in the case study by Connell.

In a comparison of the theoretical basis of modern constructivism with the recent research on activity theory, Cobb contends that these two perspectives are complimentary. This close scrutiny reveals that probably the differences between these theories are mostly philosophical in nature. In this paper we add some arguments to this conjecture. We show that basic conceptual conclusions dealing with SSDMA theory concepts and those of action-process-object-schema in constructivism theory are very similar. Both theories may complement each other to the mutual benefit.

Instructional organization at different stages of developing mental actions

The First Stage of Instruction

SSDMA theory singles out five stages in the process of instruction. At the first stage the student gets necessary information about the goals and object of the action to be developed. The structure of the action is defined which includes orientation, executive and control parts. Also links, connections and relationships with actions, notions and objects studied previously are determined. Activities at this level include explanation of the goals of the orientation part of the actions. We emphasize that this action (attributing to the concept) is not new for the students, what is new is an object of the action. We show to students that the action of attributing to a concept has the same logical structure irrespective of the object this action is aimed at.

The Second Stage of Instruction

The second stage of developing an action focuses on students performing actions in the material form. Sometimes the action consists of operations that were developed at the previous stages of instruction and some new operations that should be developed starting from the material form. Thus in developing the action of attributing to the group concept we assume that the students are familiar with the set of real numbers along with such algebraic operations as addition and multiplication and their properties. There is no need to develop group concept starting with material form if object of the action is the set of real numbers (or any subset of this set). On the other hand when we change the object from the set of real numbers to an abstract set with operations defined in the form of table it is often expedient to develop the action of attributing to the group concept in the material form.

The Third Stage of Instruction

The third stage of developing an action is that of the speech form. Describing this stage of action developing T. Talyzina wrote: *At this stage when all the elements of the action are presented in the speech form, the action is becoming more generalized but still remains not automatic and not compressed... It is imperative that the speech form of the action should be developed in the operation-by-operation mode. All the involved operations should not only take the speech form but also be assimilated in this form.* (Talyzina 1975, p.107).

As research proved, the speech form has both oral and written variants. Experiments show that the most effective way to do it is to organize cooperative work in small groups, and to get students involve into discussion. Writing across the curriculum also provides a good opportunity to develop an action in the speech form.

Forth & Fifth Stages Of Instruction

At the fourth stage the action should be developed in the inner speech form. It must be developed in the operation-by-operation mode with all the operations performed separately. Thus, it is essential in organizing instruction to provide the students with the opportunity to describe in a compressed form (for example, in the algorithm language) the operations performed or to do them in a dialogue regime either with instructor or with peers.

The fifth stage is development of action in the mental form. The action at this stage becomes an inner mental act with only the product of this action explicitly evident and observable. Mastering the action at a given level of abbreviation and generalization becomes a matter of top priority in developing the action at this stage.

Constructing Vs. Developing

In the approach developed by Dubinsky and his colleagues based on Piaget theory the goal of instruction is defined as construction of objects and processes using the method of reflective abstraction. (Cornu & Dubinsky 1989). Piaget singles out four types of reflective abstractions: interiorization, coordination, encapsulation, and generalization. Dubinsky, et. al., add one more type to this listing - reversing.

Interiorization

Piaget describes interiorization as "translating" a succession of material actions into a system of interiorized operations. Thus the initial stage of interiorization is connected with material actions through which we come to the system of interiorized operations. At the final stage of interiorization the actions are still performed in the step-by-step mode. This concept fully corresponds to the SSDMA theory prescriptions.

The SSDMA theory prescribes that if the object of study is new then the action should be developed starting from the material form. But what is "a new object of study"? In our interpretation it refers to the object whose construct is absent in the subject's mind. Therefore developing this object must start with the external form.

In the process of developing action, the object of action may not be explicitly present in the external form. In this case in reality the development either starts from the mental form, or an action is developed aimed at the model representing the object. According to the prescriptions for organization of instruction in the SSDMA theory, the action is developed from the material form to the inner speech form. Description of an action in the inner speech form is practically identical to the interiorized action that is performed in mind but still in step-by-step mode.

In this regard the following observations of a constructivist follower fully comply with the SSDMA theory's concepts. "Interiorization may not always be difficult. Most students seem to have little trouble with constructing a mental process for multiplying a matrix and a vector, or two matrices. This could be because there is a straightforward "hand-waving" action, used by most teachers. Physical representation of the multiplication could form an intermediary between an external action and its interiorization. "(Dubinsky, 1992).

So both constructivism and the SSDMA theory state that the process of interiorization starts with material actions; during this process actions are performed in the step-by-step mode. It is worth noting that the SSDMA concept of the material form of action also corresponds to constructivist concepts of empirical and pseudo-empirical abstraction.

The SSDMA theory recommends another stage in the process of interiorization, that is development of action in the speech form. It should be noted that the requirement that interiorization go through external speech is not explicitly expressed in the works of Piaget. However, in many cases experimental research dealing with organization of cooperative learning, group learning, writing across curriculum in studying advanced mathematics confirms the fact that development of activities in the form of external speech produces highly positive results. Apparently speech (or writing) can thus serve simultaneously as an external (accessible for others) and an internal process. This enables its' usage as an intermediary for the interiorization of an action.

Coordination

At the stage of interiorization all the elements of the action including its constituent operations are mental constructs, but they do not make up a whole. However, the process of developing an action implies precisely the development of a single whole - *interiorizing a whole collection of processes and coordinating them to obtain a single process* (Dubinsky 1992).

One of the independent characteristics of an action in the SSDMA theory is the degree of its abbreviation. That is, to what extent the action exists in the mind of the subject as a single whole. Considering *coordination* from the SSDMA theory perspective, we can say that one of the goals of developing an action in its mental form is coordination of all operations that are included in the operational composition of action - that is to obtain the mental action in abbreviated (not step-by-step) mode. Hence, the concept of coordination corresponds to the SSDMA theory concept of abbreviation.
Therefore, the same idea of action development from step-by-step to abbreviated mode exists in both constructivism and the SSDMA theory.

Encapsulation

In this model, encapsulation serves to convert a dynamic process into a static object. One of the indications that a process has been converted into an object is the ability of a subject to perform mental, or abstracted, actions aimed at this product of encapsulation. In the framework of activity theory such metamorphosis does not look expedient. However this theory does not impose any limitations on the objects of actions. Originally they can be either static constructs or processes.

According to the SSDMA theory, development of many mathematical concepts works with actions that from constructivist perspective are aimed at encapsulated processes. The simplest situation of this kind is development of the function concept.

Teaching the concept of function definitely involves the development of action of function evaluation at points of the domain, i.e. constructing the process of function in the students minds. On the other hand we also have to deal with development of actions in which functions appear as objects such as arithmetic operations, comparison, attributing the functions to the class of monotone functions, etc. From the SSDMA theory standpoint the concept of function can be developed only along with developing all these actions.

Therefore, if developing the function concept we follow SSDMA approach - but use constructivist vocabulary, we must say that the function concept should be constructed in the mind of the subject as a process and an object. Thus, the encapsulation as constructivism perceives it goes along very well with ideas of the SSDMA theory.

SSDMA emphasizes that an object exists in the students' mind only if they can perform generically inherent actions aimed at this object. At the same time the idea of "unpacking" an object into a process is essential for the constructivist theory. Constructivism requires that the subject should be able to "unpack" an object back to a process. SSDMA theory requires the ability to perform generically inherent actions aimed at this object. So here we have another similarity.

Generalization.

From the framework of SSDMA the degree of generalization is a characteristics of action and form of action development. From the constructivist standpoint, generalization is a form of reflective abstraction. The comparison of two theory perceptions of generalization shows that both interpret this concept basically in the same way.

Reversal

Some constructivist followers specify another type of reflective abstractions that they call reversal of a process. For example, if we perceive function as a process, then the inverse of function (or relation) will be a reversal of this process. Another example is a subtraction as a reversal of addition.
The idea of process reversal is also present in the SSDMA theory. Many actions have natural explicit reversals. Let us consider an action of taking a candy. From an early age the child is taught that there exists a reversal action - putting it back. In every day life we come across this dichotomy of actions everywhere and this concept of reversal is part of our thinking process.

We mentioned that all the operations that are parts of an action belong to three categories: orientation, executive and control. For a lot of actions the control part consists of performing the reversed action. If we go back to our example with candies the best way to verify that the action of adding took place properly is the ability to take the candy from the table, that is to perform the reversed action: i.e. to take them from the table.

Conclusion

If one sets aside surface differences and focuses upon specific recommendations we see that practical general guidelines for organizing instructional processes proceeding from recommendations of constructivist and SSDMA theories are very similar. Indeed, there exists a correspondence and similarity between basic ideas and concepts of these two theories.

This is clearly seen in the concept of action-process-object-schema as it describes the mechanism of action development. This is particularly true when we investigate the question: *What are we constructing and developing?* The concept of *forms of action* and their characteristics provides a method of realization of this mechanism and gives the answer to the question: *How should it be constructed and developed?*

The practical perspectives of constructivism and SSDMA theory complement each other. From the theoretical perspective, the constructivist theory provides a possibility to further evolve characteristics of action (i.e., to review an action in the form of a process). On the other hand, SSDMA introduces new stages in the action-schema concept construction along with such characteristics as form, generalization, step-by-step operations, provides pragmatic criteria both for the choice of means of instruction and design of practical assignments at each stage of instruction.

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Interpretation of SP Charts on Mathematics Applications.

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Abstract: The analysis of response patterns is motivated by the belief that additional instructional information is contained in the analysis of the errors student make in responding to test items. In this paper we will present a method of organizing, analyzing, and reporting test results that is useful to the mathematics classroom teacher. Most of the time the only information that a student sees is his final score. Even on teacher-made tests the students often only see a total score because of the time and effort necessary to get diagnostic material from the test. Test data can be analyzed very efficiently with the use of microcomputer test analysis software. The Student-Problem Package provides an informative report of diagnostic value to the student and teacher.

Introduction

The Student-Problem Package (SPP) on the IBM-PC is a program for analyzing student responses on tests. The SPP is based on Student-Problem curve theory developed by Takahiro Sato at NEC Corporation, Tokyo (Sato, 1990). The use of S-P curve theory allows us to recover additional information from the pattern of responses by students to items. In addition to this, it enables the documentation of classroom growth that escapes many other evaluative tools.

Basics of the SP Chart

S-P Chart

The S-P Chart is an ordering of the student's responses to the items in the form of a table. Figure 1 is an example of the responses of 15 students to 10 problems (items). Each row of this response matrix contains the responses of a student; a "1" indicates a correct response, while a "0" represents an incorrect response. The columns of the matrix correspond to items on the test and the resulting matrix of 1's and 0's is referred to as a binary matrix.

The sum of each row represents the raw score (total score for each student. The column sum represents the number of students correctly responding to each item. The next step is to order the problems from easiest (most number of students answering correctly) to hardest, and then order the students from highest total score to lowest total score. Figure 2 represents this rearrangement of the student and item information from Figure 1.

Problem Number

Student	01	02	03	04	05	06	07	08	09	10	Row Total
Andy	0	1	1	1	0	0	1	0	0	1	5
Bart	0	1	1	1	1	1	0	0	0	0	5
Chip	0	1	0	0	0	0	1	0	1	0	3
Debi	1	1	0	1	0	1	1	0	0	0	5
Edna	1	1	1	1	1	1	1	0	0	1	8
Fred	1	1	0	1	1	0	0	0	0	1	5
Gail	1	1	1	1	1	1	1	1	1	1`	10
Hank	1	0	0	0	0	0	1	0	1	0	3
Ilga	0	1	1	1	1	1	1	1	0	0	7
Jane	0	1	1	0	0	1	1	0	0	1	5
Kirk	1	1	0	0	1	0	0	1	1	0	5
Lane	0	0	1	0	0	0	0	0	0	0	1
Mary	0	1	1	1	0	1	0	1	0	0	5
Nell	0	0	0	0	1	0	0	1	1	1	4
Opus	1	0	1	1	0	0	1	0	1	0	5
Column Total	07	11	09	09	07	07	09	05	06	06	

Figure 1. Matrix of Student Responses to 10 Items and Row and Column Sumns ('1' = Correct Answer, '0' = Incorrect Answer)

Problem Number

Student	02	03	04	07	01	05	06	09	10	08	Row Total
Gail	1	1	1	1	1	1	1	1	1	1	10
Edna	1	1	1	1	1	1	1	0	1	0	8
Ilga	1	1	1	1	0	1	1	0	0	1	7
Andy	1	1	1	1	0	0	0	0	1	0	5
Bart	1	1	1	0	0	1	1	0	0	0	5
Debi	1	0	1	1	1	0	1	0	0	0	5
Fred	1	0	1	0	1	1	0	0	1	0	5
Jane	1	1	0	1	0	0	1	0	1	0	5
Kirk	1	0	0	0	1	1	0	1	0	1	5
Mary	1	1	1	0	0	0	1	0	0	1	5
Opus	0	1	1	1	1	0	0	1	0	0	5
Nell	0	0	0	0	0	1	0	1	1	1	4
Chip	1	0	0	1	0	0	0	1	0	0	3
Hank	0	0	0	1	1	0	0	1	0	0	3
Lane	0	1	0	0	0	0	0	0	0	0	1
Column Total	11	09	09	09	07	07	07	06	06	05	

Figure 2. Students Arranged from High to Low and Items Arranged from Easiest to Most Difficult

S-P Curves

There are two lines that can be drawn on the S-P Chart. The S-curve is drawn by placing a solid vertical line over each S whose position corresponds to the total test score earned by the student represented by that row. The S-curve is completed by starting at the bottom of the chart and connecting the top end point of each vertical line segment to the bottom end point of the line segment to the left end point of the line segment above it. Figure 3 shows the S-curve drawn onto the data previously presented in Figure 2.

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```
                  Problem Number

                0 0 0 0 0 0 0 0 1 0  Row
Student         2 3 4 7 1 5 6 9 0 8  Total
--------------------------------------
Gail        |   1 1 1 1 1 1 1 1 1 1S  |10
            |                         |
Edna        |   1 1 1 1 1 1 1 0S1 0   | 8
            |                         |
Ilga        |   1 1 1 1 0 1 1S0 0 1   | 7
            |                         |
Andy        |   1 1 1 1 0S0 0 0 1 0   | 5
            |                         |
Bart        |   1 1 1 0 0S1 1 0 0 0   | 5
            |                         P
Debi        |   1 0 1 1 1S0 1 0 0 0   | 5
            |                     P P |
Fred        |   1 0 1 0 1S1 0 0 1 0   | 5
            |             P P P       |
Jane        |   1 1 0 1 0S0 1 0 1 0   | 5
            |                         |
Kirk        |   1 0 0 0 1S1 0 1 0 1   | 5
            |     P P P               |
Mary        |   1 1 1 0 0S0 1 0 0 1   | 5
            |                         |
Opus        |   0 1 1 1 1S0 0 1 0 0   | 5
            |P                        |
Nell        |   0 0 0 0S0 1 0 1 1 1   | 4
            |                         |
Chip        |   1 0 0S1 0 0 0 1 0 0   | 3
            |                         |
Hank        |   0 0 0S1 1 0 0 1 0 0   | 3
            |                         |
Lane        |   0S1 0 0 0 0 0 0 0 0   | 1
--------------------------------------

Column          1 0 0 0 0 0 0 0 0 0
Total           1 9 9 9 7 7 7 6 6 5
```

Figure 3. S-P Chart (S- and P-Curves Superimposed on the Sorted Data Matrix

The S-curve provides a visual display of the proficiency level of the students in the classroom. A Vertical S-curve represents a homogeneous classroom (one in which most of the students are performing very similarly), where a diagonal S-curve is evidence of a heterogeneous classroom (a wide range of performance). An S-curve shifted to the right shows a high proficiency level in the classroom.

The P-curve is drawn in a similar manner except that the roles of students and items are reversed. A dotted horizontal line segment is drawn over each P whose position corresponds to the number of students correctly answering the item represented by that column. Starting at the bottom of the chart and connecting the right end point of the line segment above it completes the P-curve. Figure 3 shows the P-curve for the previous data.

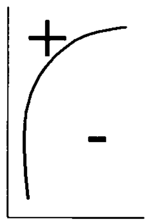
In an ideal classroom with an ideal test (where everything tested is taught and learned) the S and P-curves would coincide. It is quite common to have the S and P-curves diverge a little from each other, due to individual differences commonly observed in the classroom. If the test is measuring information not covered in the classroom, the divergence will be increased. A large divergence between the S and P-curves signals a possible mismatch of test objectives and instructional objectives in the classroom. A disparity index is given in the SPP analyses for each S-P chart. A disparity greater than .25 is a danger signal (Harnisch, 1983).

Classroom progress from examining the S-Line.

With this background it is possible to imagine a multitude of uses for the SP Chart. One such use which has shown itself to be very helpful in field based projects is to document classroom improvement

over time. Often in the initial stages of an intervention there has not been sufficient time for a significant gain to be shown on standardized testing measures, yet both the researcher and the classroom teacher are in complete agreement that tremendous progress is being made. The dilemma becomes one of documenting this growth in a form which is communicable to others.

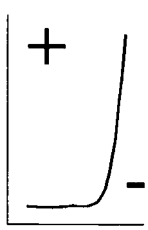
At this point the SP Chart can provide a tremendous insight into the classroom changes underway. For simplicity, this example will look only at the S-Line as defined in the preceding sections. As we examine beginning S curves at the beginning of an intervention patterns similar to the following are often observed:



In quickly examining this curve a few observations may immediately be made. First, the relative number of items mastered by these students is relatively small. Secondly, in order for this class to show real growth an increase in the number of mastered items must be achieved. This is in marked contrast from many administrative foci that look for simple gains in scores without concurrent conceptual mastery. For example, it is entirely possible to imagine two S-Lines, identical to that shown above, differing by a statistically significant amount.

If this were all that has been accomplished in the classroom, however, one would be hard pressed to argue that real growth has been achieved. We began with a group of students, who despite their instructional history, have managed to master the content. The rest of the class has not, although they do have a measured level of incompetence as shown. We end with a higher average of incompetence – i.e., the mean classroom score, yet still have the same students mastering the content. And again, often mastering the content despite the instructional intervention. This is clearly not what we intend in a reform effort.

Let us now consider a second curve typical of many intervention projects.



Now, to make the interpretation more poignant, let us imagine that the classroom mean from this second curve is equal to (or even less!) then that of the proceeding curve. From a simple mean comparison perspective there has been no result to the intervention whatsoever! Yet, in examining the S-Curve we can easily see that despite a lack of mean increase we see a large number of students who are now progressing in their mastery of concepts. This classroom is rapidly becoming an environment within which meaningful mathematical dialogue may take place.

The SP Chart, when used in this fashion, has the potential for documenting growth that is typical within reform oriented classroom and which often slips between the cracks of standard evaluation methods. When one considers the number of otherwise effective interventions which have been abandoned due to "lack of progress", this technique shows extreme merit.

Conclusion

Analysis of item response patterns using the S-P approach provides a method of systematically looking at achievement patterns on common areas of content and of documenting difficult to measure

classroom progress. Detailed output from SPP gives a teacher a concise report identifying instructional areas in need of review as well as students with unusual response patterns. Diagnosis of the procedural errors as identified in these analyses is an important area of interest to many educators.

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Preparing K-12 Mathematics Teachers to Use a Spreadsheet as an Instructional Tool

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Abstract: This paper reflects on activities to help prepare elementary and secondary mathematics teachers to use a spreadsheet as an instructional tool. Collaboration on this paper was born out of common epistemological, pedagogical, and mathematical beliefs held by the authors regarding a spreadsheet as an exploratory learning environment. The authors agree that spreadsheets can enhance mathematical understanding and teachers should develop proficiency with using the tool in an exploratory and investigative manner. This paper will highlight the integration of spreadsheets into different mathematics teacher education programs and demonstrate different approaches that can enrich and inform spreadsheet-enabled mathematics pedagogy.

Introduction

An important aspect of the current reform movement in mathematics education is the continuous growth of mathematics teachers as technologically informed professionals. Such growth implies that the teachers are given an opportunity to gain experiences using and helping their students use computers to pursue mathematical explorations and investigations. Because skillful utilization of computing tools in mathematics instruction enables the exploration of topics which might be beyond students' grasp with only pencil and paper, the teachers' comfort level with computers as instructional tools can affect the nature of mathematics education dramatically. What was an elite knowledge in the past can become knowledge for all in the age of computers. In order to allow this to happen the mathematical and methodological preparation of teachers should include deliberative and purposeful experiences in the design of technology-integrated lessons through the use of appropriate computer applications.

Recently the President's Committee of Advisors on Science and Technology, Panel on Educational Technology [Shaw et al., 1997] prepared a number of high level strategic recommendations related to the effective use of technology within America's schools. In particular, the Panel emphasized the importance of technology-oriented pedagogy that promotes learning with technology versus learning about technology. This implies that the focus of computer-enhanced teacher education courses should be the application of a computer as a cognitive tool to enhance student learning of content material (e.g., mathematics, social studies, science) and not the acquisition of isolated skills in basic computing applications (e.g., word processing, database, spreadsheets, hypermedia) or operating a computer by using a specific programming language.

This paper reflects on activities associated with courses designed for elementary and secondary mathematics teachers with a goal to address the above issues. The courses were conducted recently by the authors at the universities of Illinois, New York, and Virginia. Collaboration on this paper was born out of common epistemological, pedagogical, and mathematical beliefs held by the authors regarding a spreadsheet as an exploratory learning environment. The authors agree that spreadsheets can enhance mathematical understanding and teachers should develop proficiency with using the tool in an exploratory and investigative manner. However, the didactical focus of the spreadsheet-enabled pedagogy varies across the courses. The integration of spreadsheets into different mathematics teacher education programs highlighted the existence of several approaches within a common conceptual framework outlined by the Panel. This collaborative paper demonstrates how differences in the approaches can enrich and inform spreadsheet-enabled mathematics pedagogy. In what follows, each approach will be described by the respective author.

Spreadsheets in Elementary Teacher Education Degree Programs

Going Beyond the Information Given with Spreadsheets

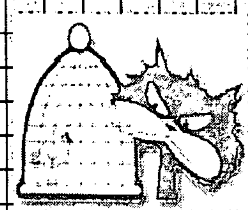
Courses for elementary pre-service and in-service elementary teachers which incorporated a spreadsheet were conducted by the first author at the University of Illinois, Chicago (4 credit hours course) and in graduate degree MST program at the State University of New York, Potsdam (3 credit hours course). In the context of these courses the tool was used as a medium conducive to the extension of a real-life situation presented through a "realistic" problem. The latter, in turn, was designed in such a way that allowed for a paper-and-pencil solution, yet a spreadsheet was especially amenable for modeling different variations of the original problem as a way of exploring "what if" questions that stemmed from it. An emphasis of the course was to provide the teachers with experience of how mathematical concepts evolve from a familiar quantitative situation if one is allowed to problematize the familiar in a purposeful way and then utilize a spreadsheet for modeling the concept. Whereas a non-spreadsheet solution may be based on an intuitive approach, a spreadsheet solution requires a conceptual understanding of underlying relationships that structure the quantitative (problematic) situation. This approach reflected an intrinsic nature of any mathematical concept that arises from an intuitive observation in order to be utilized further in attending more and more abstract structures. Through the use of a spreadsheet as a medium for developing such structures the teachers were given an opportunity to experience the discovery and re-invention of mathematical ideas through computer-mediated activities, appreciate meaningful links among different concepts through exploiting their multiple representations - iconic, numeric, and graphic-in a spreadsheet environment.

Spreadsheets and the Diversity of Thinking

The first author also taught a technology-enhanced 3 credit hours course for elementary pre-service teachers at the State University of New York, Potsdam that incorporated a spreadsheet from another perspective. In many instances, a didactical focus of using a spreadsheet as a cognitive tool was to challenge a conventional belief held by elementary pre-teachers that there is one and only one way of acting, representing, and comprehending. In other words, such focus promoted the diversity of thinking among teacher education undergraduates. More specifically, consider the following problem from pre K-2 Core Curriculum in Mathematics (New York State Education Department, 1998): *A pet store owner sold only birds and cats. One day he asked his clerk to count how many animals there were in the store. The clerk told him he counted 18 legs. How many cats and birds might there have been?* This mathematically rich problem can be presented in a variety of ways one of which is a spreadsheet modeling. A computational approach to the problem can help pre-service elementary teachers develop a cognitive bridge between arithmetic and algebra. In addition, the spreadsheet modeling of the above "realistic" situation may help the teachers to comprehend a mathematical model provided by the Diophantine equation $2B+4C=L$, where variables B, C, and L stand for the number of birds, cats and legs, respectively. Figure 1 presents both in numeric in graphic forms the results of modeling of the problem for different totals of legs counted. In particular, the case of 18 legs (numbers in a dark part) bring about 5 different solutions (within a specified range of the total of pets) whereas 70 legs allow for 2 solutions only (within the same range). The use of a spreadsheet makes it possible to easily explore numeric patterns and their graphic representations related to some “monsters” with 3, 5, 7, etc. legs.

In comparison with an off-computer environment that can be used for exploring the above problem, the use of spreadsheet modeling allows for a broader picture of mathematical relationships that structure the above problem. Following a theoretical tradition in which learning is built on the foundations of capacities that kids use in non-volitional manner (Vygotsky, 1997), it is of a fundamental importance to have an environment which can help pre-service elementary teachers enhance conceptual understanding of mathematics being taught at K-2 level. Mathematical modeling with spreadsheets is one possible way to accomplish this goal. It enables elementary teachers to link seemingly disconnected ideas across the K-12 curriculum so that, in turn, children can construct meaningful links between several mathematical ideas learned at different grade levels.

B \ C	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	0	2	4	6	8	10	12	14	16	18	20	22	24	26
1	4	6	8	10	12	14	16	18	20	22	24	26	28	30
2	8	10	12	14	16	18	20	22	24	26	28	30	32	34
3	12	14	16	18							32	34	36	38
4	16	18	20	22							36	38	40	42
5	20	22	24	26							40	42	44	46
6	24	26	28	30							44	46	48	50
7	28	30	32	34							48	50	52	54
8	32	34	36	38							52	54	56	58
9	36	38	40	42	44	46	48	50	52	54	56	58	60	62
10	40	42	44	46	48	50	52	54	56	58	60	62	64	66
11	44	46	48	50	52	54	56	58	60	62	64	66	68	70
12	48	50	52	54	56	58	60	62	64	66	68	70	72	74
13	52	54	56	58	60	62	64	66	68	70	72	74	76	78



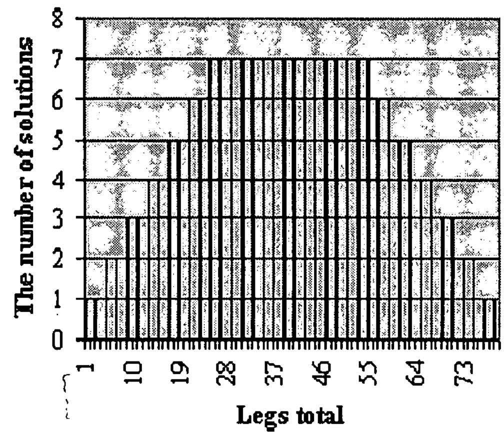


Figure 1. Numeric and graphic modeling of the Pet Store problem

To conclude this section, note that the focus of the above computer-mediated activities was to provide pre-service elementary teachers with experience of (i) how a teacher can take a problem from curricula materials, and extend it by using a spreadsheet; (ii) what does it mean to use technology appropriately, (iii) how a teacher can engage students in guessing, conjecturing, and debating; (iv) how a teacher can use a spreadsheet with children to explore in depth a "realistic" situation (content-bounded problem); (v) how can a teacher make students experience the need for justification and proving of emerging conjectures; and (vii) how technology can present mathematics as a dynamic discipline and subsequently create an interest toward mathematics.

Spreadsheets in a Secondary Mathematics Methods Course

During the five-year BA/MT secondary mathematics teacher education program at the University of Virginia, preservice teachers are required to take a two-semester secondary mathematics methods course. Within this course, preservice teachers are engaged in a variety of different activities and discussions that address such topics as problem solving, the National Council of Teachers of Mathematics *Standards* (1989), constructivism, assessment, curriculum and instruction in middle and high school mathematics, and effective use of technology. The Curry Center for Technology and Teacher Education is currently funded to develop materials to help pre-service and in-service secondary mathematics and social studies teachers learn to incorporate technology into their teaching. The second author and other members of the mathematics group at the University of Virginia are currently developing activities that give teachers a variety of experiences using graphing calculators, spreadsheets (Microsoft Excel), The Geometer's Sketchpad, MicroWorlds, java applets, internet resources, and specific software programs such as Green Globs. These activities are then integrated throughout the aforementioned secondary mathematics methods course.

Taking Advantage of Spreadsheet Capabilities to Extend Mathematical Learning

The second author has developed spreadsheet activities that are designed to introduce teachers to several different uses of a spreadsheet for exploring mathematical concepts with middle and high school students. The teachers experience the various capabilities of the spreadsheet by: 1) analyzing data numerically and graphically, including importing data from the internet, 2) exploring recursive patterns numerically and graphically, 3) creating interactive simulations such as probability events and projectile motion (figure 2), and 4) creating templates for use as instructional tools to investigate problems such as maximizing area of a rectangle given a fixed perimeter and the effect of coefficients on the graph of general forms of equations.

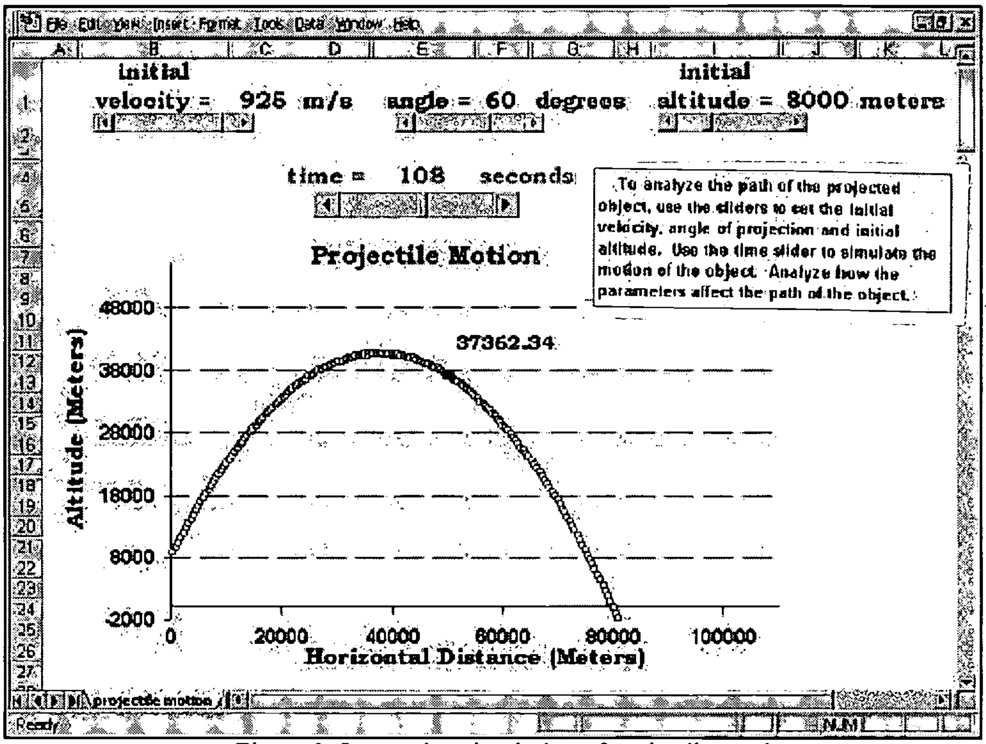


Figure 2: Interactive simulation of projectile motion
(Originally developed by Jerril Burnette, a preservice teacher, as part of a class project)

Many of the activities investigate mathematical concepts that arise from real world contexts (e.g., analyzing natality data, exploring the relationship between smoking and lung cancer, investigating projectile motion) and are connected with topics in the social studies and science curriculum. All activities are designed to enhance the teachers', and subsequently their students', understanding of mathematical concepts by using several mathematical representations (numerical, graphical, symbolic, verbal) and taking advantage of spreadsheet capabilities that allow the learner to extend beyond or significantly enhance what could be done using paper-and-pencil. Using spreadsheets to teach the same mathematical topics, in fundamentally the same ways, that could be taught without technology does not strengthen students' learning of mathematics and belies the usefulness of spreadsheets. Thus, the activities take advantage of the available statistical analysis tools, the ability to link cells to create dynamic calculations and graphs, and the control forms (e.g., sliders) that can promote interactive and open-ended exploration of mathematical concepts. By using a spreadsheet to investigate mathematical concepts and problems, the teachers gain experience using a variety of functions and features of the spreadsheet. The teachers are also engaged in classroom discourse about mathematics as well as how and when to integrate spreadsheets in middle and high school mathematics curricula.

The approach used by the second author to prepare teachers to use spreadsheets as an instructional tool has multiple purposes. First and foremost, the activities are designed to enhance and extend teachers' knowledge about mathematics and to promote a problem solving, exploratory approach to doing mathematics that take advantage of the capabilities of a spreadsheet. Secondly, the teachers learn features of a spreadsheet within the context of solving mathematical problems and thus gain experience and knowledge of appropriate uses of a spreadsheet for teaching middle and secondary mathematics curriculum. A third purpose is to engage teachers in discussions on effective and appropriate uses of spreadsheets, and technology in general. As a final purpose, throughout the two semester course, the teachers create lessons and/or spreadsheet templates (such as the one shown in figure 2) that utilize features of the spreadsheet to teach mathematical concepts in such a way that significantly extends what is possible with paper-and-pencil.

Conclusion

The use of technology in mathematics teaching should support and facilitate conceptual development, exploration, reasoning and problem solving, as described by the NCTM (1989; 1991). Furthermore, both authors believe that teachers who learn how to use technology (e.g., spreadsheets) while using it to explore mathematical topics are more likely to see its potential benefits and use it in their subsequent teaching. Although the contextual setting for the courses taught are quite different, the purposeful use of a spreadsheet as a cognitive tool for learning mathematical concepts is similar. Various instances of using an electronic spreadsheet program in mathematics education suggest that incorporation of this software into teacher education courses and subsequently into K-12 school settings can significantly affect school mathematics instruction. The authors argue that spreadsheets may be construed as a new generation of school-based educational software which use is not limited by financial constraints and commercial availability. Indeed, spreadsheets are commonly available in most schools as part of packages such as Microsoft Office, ClarisWorks, and Microsoft Works and even considered by many school administrators as one of the basic components of computer literacy. Nevertheless, there is a gap between using a spreadsheet as an accounting program and as a tool for conceptual development and educative growth. Therefore teachers' proficiency in the use of a spreadsheet as a cognitive tool becomes a crucial factor in advancing its use in the classroom.

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Acceptance of a Maths Online Project

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Abstract: Since March 1997, the University of Vienna hosts the project maths online. Its goal is the creation of a coherent online program suitable for maths teaching and self-learning, covering a range of six years mathematics education. Its web site

http://www.univie.ac.at/future.media/moe/

is freely accessible. Experiences concerning the acceptance of the program among teachers and students are reported.

The "maths online" project

In March 1997 a project was launched at the university of Vienna whose goal is to create a coherent online program on mathematical topics, suitable for being used in the framework of school classes, adults education and undergratuate university courses. The envisaged contents covers most of the issues students are usually confronted with from the age of 14 or 15 years.

The - larger - german version of the material is hosted at

http://www.univie.ac.at/future.media/mo/

(a link leading to the - smaller - english version) and is updated regularly. Technically, it consists of

- a "gallery" of multimedia learning units (dynamical diagrams designed as Java applets) on various topics, usually dealing with the introduction of crucial mathematical notions and testing the understanding of key concepts,
- a collection of WWW links to mathematical topics and online tools,
- a hypertext-based outline of the mathematical background, ordered by chapters (only in the german version), and
- an alphabetically ordered glossary (only in the german version).
- Future perspectives are the inclusion of interactive exercises and tests, as well as material on the historical background.

The material is developed by the author together with Petra Oberhuemer from the same Institute, in collaboration with school teachers, trainers in adults education, and maths didactics specialists from the University of Vienna. During its first year, the project is supported by the Austrian Ministry of Education and the Arts, the Austrian National Bank and the Vienna Association for People's Education. It is which freely accessible for everyone.

So far, we have received reactions – to be reported below – on an individual basis of interested teachers and students. During the next term (summer 1999), empirical tests in school and adults education will be performed.

General accessibility problems

When starting to bring the project to the attention of teachers and students several months after its start, we could observed some general problems (most of which were known previously)..

- The most trivial problem was simply the lack of appropriate internet connections in schools. Thanks to an initiative of the Ministry of Education, the situation is just about to improve.
- A more severe problem is the technical equipment of schools, regarding computers and network utilities. A number of schools are listed as "connected" to the internet, but offering only E-mail service for teachers and, in some cases, a single (!) computer running a web browser. We expect some degree of improvement regarding these matters as well, although at a slower rate, on account of budget issues in the Austrian school system.
- An almost common problem is the small number of computers suitable to run multimedia applications and to provide web connections. The situation in most schools reflects the traditional use of computers in special computing courses, but essentially disjoint to all other subjects. Computer and new-media issues are quite often regarded as being completely separated from teaching mathematics or, say, biology.
- The general knowledge among Austrian teachers about the use of computers, multimedia and the web is quite low. Cultural techniques for improving these qualifications have not jet developed at a large scale. In addition, the responsibility for the hard- and software in a school is usually held by one particular teacher. Lack of time available for new-media issues, and a fairly underdeveloped communication structure among the colleges is quite often a reason for a de-facto accessibility restriction. Amazingly, even mathematics teachers do not seem to provide exceptions to this rule.
- In addition, students often show better computer skills (and faster learning abilities) than teachers. This in turn questions the teachers' authority – a situation which often induces an inner resistance against the use of new media.
- A further de-facto restriction of online material used in mathematics education is provided by the fact that teachers in general do not really like to download software from the web. Apart from the variety of technical skills necessary to use the internet creatively, it is sometimes not even clear whether a non-computer-specialist teacher is entitled to download software. Thus it does not seem wise to make wide-spread learning software dependent on browser plug-ins. This situation was our main reason for avoiding the necessity of plug-ins and transporting the required multimedia functionality of "maths online" by Java applets.
- It needs however to be said that a number of teachers is willing to face and overcome all these problems actively. In total, the Austrian school system hosts several pioneering mathematics projects, the largest ones centered around the use of the calculator *TI-92* and the computer algebra system *Mathematica*. These initiatives will help to spread the general knowledge about and acceptance of new techniques in maths education among the majority of teachers.

Acceptance of "maths online"

In what follows we shall focus on teachers' and students' reactions on the "maths online" project. In order to be able to receive systematic feedback, the developers announced E-mail addresses and provided an online questionnaire at the website of "maths online". Personal contacts to school teachers completed the communication process.

The reactions were fairly positive in general. Some suggestions concerned the detailed design, functionality and usability, which we have taken into account as far as possible. Let us list some observations of more general relevance.

The core of the visualization material is its multimedia functionality – the way how scroll bars, mouse drag actions and the like are integrated into mathematical scenarios. Practically all responses we obtained were fairly enthusiastic about the way this functionality was designed. This is a strong signature of acceptance of some of our key concepts of "multimedia didactics". Also, it was conceded quite generally that "maths online" is capable of improving one's understanding of mathematical notions and facts, and that it may - in principle - be integrated into maths education in a helpful way. In these respects, the rates given to us were encouraging. However, possible acceptance problems arise at different levels, and we will now list some of the most interesting issues.

- Some of the applets are designed to illustrate the introduction of new key concepts. An example is the applet "On the definition of the derivative"
(http://www.univie.ac.at/future.media/moe/galerie/diff1/diff1.html#ableitung).
By moving a scroll bar, the geometrical construction for "measuring" the derivative of a function moves along with the x-coordinate. The function graph displayed is prescribed once and for all, since the purpose of the applet was not to be applied to various functions but to help *understanding* what is meant by the

concept of the derivative. In principle, this notion could be introduced without reference to finite difference quotients. The only new element necessary to approach it is the tangent to a curve – which is immediately appealing in an intuitive way.
However, several teachers asked for the possibility to vary the graph displayed. They did not primarily look at the applet as a visualization of a concept but as a *tool*, to be used in various situations. They did not seem to accept intuitive understanding as a primary goal of a learning unit, but were more focused on tools suitable to *do* something, and to learn by doing.
This is a very interesting point, since it affects the discussion about constructivist learning: To what extent is fast and intuitive understanding – without much labor – possible? Does the teachers' reaction reflect the students' best ways of approaching concepts or does it emerge from the traditional point of view that *understanding* is postponed until enough has been *done*. Or does it just express the need to adopt appropriate tools for just the situation encountered here-and-now in an individual class?
Topics like this will be one of the crucial points to examine in future empirical tests.

- There was a further series of reactions indicating that teachers wish to have *tools* at their disposal, even if the adoption thereof for their lessons will cost a considerable amount of time. Some of the applets were designed as jig-saw puzzles. By mouse dragging, the user shall associate corresponding terms to each other, or answers to questions, or the like. Surprisingly, these puzzles were the most successful part of "maths online" so far! Maybe this is so because they in fact appear in the form of "games". We have several times listened to students of all ages denoting them as "cool".
However, they are not at all *simple* – we have tried to show that quite sophisticated matters may be designed in this form, e.g. the reconstruction of the proof of the formula for the solution of a quadratic equation, "Quadratic equations 2"
(http://www.univie.ac.at/furture.media/moe/galerie/gleich/gleich.html#quadr2).
A frequent reaction of teachers was the need for customizing their own puzzle applets. We have provided a comfortable possibility to do so (input of the entries by web page) – see the link " Puzzle creation page" on the Welcome Page of "maths online".
- The overall approach of teachers towards the applets was seemingly to integrate them as individual units into their courses, separated from the rest of "maths online". Maybe this is a reaction for individuals responsible for their educational activities. So far, we could not verify the well-known phrase that teachers just want material whose use is strictly ruled. (On the other hand, there are already materials in use which do not leave much room for customization – the maths textbooks. Maybe the situation bears some slight competition between book and web). This reaction may be appreciated – nevertheless, it shows that suggesting a different pedagogical approach of, say, a complete chapter as a whole is a rather difficult enterprise.
It remains to be seen in future empirical tests whether this situation also persists in the framework of adults education.
- The second group of material is a series of hypertext-based documents on particular mathematical subjects. (They are only available in the german version). There purpose is to introduce the user who wishes a concise exposition of mathematical "facts" or who just wants to find some information on a particular topic embedded in a larger context. Moreover, these pages will – in the final version – carry all the necessary tutorial and navigational information ("now call this applet" and "now try that test"). Moreover, we have tried to keep the text and formal exposition in a form that should be understandable for the user, even if she just jumps right into a page, as would occur with a book.
Nevertheless, here a possible limitation of the web as valuable media might arise: Users do in general not expect to find pages involving text and mathematical formulas, nor are they ready to read long pieces of text on the screen. This provides problems, in particular for designing an online help system concerned with difficult and formal mathematical contents. An online help system has to include descriptions of essentially the same form (and language) as will arise in "real world" examinations. On the other hand, users tend to expect fun and "easy learning" on the web. The fact that - at some level of sophistication - written (or spoken) arguments and formulas using various symbols are an essential part of mathematics, seems to be hard to accept, even when using a maths-on-the-web system. This provides a further source of acceptance problems.
A possible way out of this situation is to offer (and explicitly suggest) the user to work interactively at the screen and/or to use printed hard-copy versions of the relevant documents in a suitable combination. In class, this could mean to encourage students to "give a seminar" on a topic, based on these documents.
- Teachers' reactions indeed showed very little readiness to include the hyper-text documents as teaching material into their courses. (This may in part arise from the way maths text books are used in Austrian

schools: mainly as a source for exercises. Even desperate students usually do not consult their text book when preparing for an examination).

- However, few colleges announced to advice their students to work with the text *as text* in addition to the applets. The experiences arising from these attempts will be of high value for the future design of "maths online". Also, it will be an interesting issue in future empirical tests how this situation changes in the framework of adults education, where self-learning aspects become more important as compared to school teaching.
- There is another possible source of acceptance issues. Almost all applets have a button named "Exercises", which provide concrete instructions for testing one's understanding (or constructing a concept). We have noticed a very little readiness to click these buttons! In particular persons who just liked to have a brief look at "maths online" seemed to simply overlook them. Also students, when merely asked to "go through" an applet, took rather long time before activating the "Exercise" buttons. Surprisingly, the buttons named "Didactical background" - designed as a brief information for teachers - were far more attractive for them to click.
- A good interface immediately tells the user what to do. On the other hand, a well-designed mathematical diagram or visualization interface shall not carry too much text external to its topic. These two principles seem to interfere here. It remains to be tested whether students easily get along with a design in which relevant texts are "hidden" behind buttons.
- One of the general design principles of "maths online" is the extensive use of browser and applet windows which do not stretch over the whole screen but are easily recognizable *as windows*. This shall minimize the loss of orientation ("where am I?") which may easily occur when a new web page is loaded into the browser. In contrast, the appearance of a (smaller) window evokes the question "what's in there?" rather than "where am I?". We seem to have done this point well, because most feedback states that the material is well-structured and easy to overview.
- In general, the acceptance of "maths online" was better by persons who already bring along a considerable amount of experience with computers, internet and learning software, rather than from "newcomers". In particular, teachers who have been engaged in the past into related issues and have done pioneering work by themselves, gave it the best rates.
- In general, the acceptance of "maths online" was better by teachers and students who looked at it in more detail and spent more time on it rather than just briefly skipping through it. It seems by no means easy to judge on a program like ours "at a glimpse". (Unfortunately, the speedy atmosphere of the web seems to leave some imprint even on media and pedagogical experts, at least as long as it is not clear what an "expert" in this field is). This situation may indicate that "accidental" and impatient users are difficult to win. The best situation to get acquainted with our program seems to be a lesson or course atmosphere in which the material is declared part of the learning method by the teacher.

It is not easy to draw viable conclusions from the response obtained so far, before having carried out systematic testing. The main lesson we have learned is that – although the general usability of "maths online" and the way how multimedia techniques were integrated into mathematical situations is easily accepted – some intrinsic requirements how to present online maths material are on the verge of being non-compatible with spontaneous user expectations. We conclude that

- developers of learning software should deal with such potential acceptance problems in a careful way,

and that

- users should not expect online learning to be pure fun, but might have to get used to a novel way of discipline.

The results of empirical tests to be performed during 1999 will be posted on the "maths online" website.

The Instructional and Technological Challenges of a Web Based Course in Educational Statistics and Measurement

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Abstract: This paper describes the development of the web site for a graduate course in statistics and measurement, and offers recommendations for future continued development of this and other web-based courses within the field of education. The site was initially designed to supplement the course as it was currently being taught. An overview of the basic structure of the web site and how specific units are being converted to be delivered online is presented. As a part of a formative evaluation, students enrolled in the class were surveyed regarding their perceptions of the web site and how it had contributed to their educational experiences. Although apprehensive at first, student response to the web site was very positive.

Introduction

In an attempt to tap into a potentially large market, many colleges and universities are now jumping on the bandwagon and restructuring their existing courses to be offered via the Internet. Increasing numbers of students will no doubt be using the Internet more frequently in the future in many aspects of their coursework and in their jobs for research, communication and collaboration. The convenience of taking higher education courses over the Internet will attract many students to earn credits on-line. The number of providers of Internet-based instruction continues to grow as does the number of student desiring nontraditional delivery methods of instruction (Puyear, 1997). Students have the right to expect a high level of quality from web-based courses that they pay for. And instructors are responsible for developing quality web based courses that result in stimulating learning experiences for all students (McGonigle & Eggers, 1998).

In response to the growing trend towards web-based instruction, the Dean of the School of Education at a small upper division university in southeast Texas gave three faculty members the task of exploring how three core courses of the Master's degree program could be delivered via the internet. This was a summer time project initiated as part of a long term goal to deliver the entire School of Education Master's degree program online. Faculty were given the freedom to develop these web-based courses without any requirements or restrictions on what could be accomplished. It was felt that whatever progress could be made during this short time period would provide valuable initial feedback that could be applied to the continued development of these three projects, as well as the further development of other university web-based courses. An instructional designer/developer was assigned to each faculty member on a part-time basis to assist with the technical aspects of the project.

The Course

One of the three courses to be offered via the Internet is a graduate level course in educational statistics and measurement. This course is required of all master's students in the School of Education, as well as post-baccalaureate students seeking teacher certification. The primary course objective is for the student to acquire an understanding of basic descriptive statistics and the principals of measurement. The course is divided into three content areas: basic descriptive statistics, including levels of measurement, frequency distributions, and measures of central tendency, variability and relationship; principles of measurement, including test construction procedures, item analysis, reliability, and validity; and measurement topics, such as assessment in education, standardized measures of aptitude and achievement, other approaches to assessment, and program evaluation. Prior to this project, efforts to infuse technology into the course included using spreadsheet programs such as *Microsoft Excel* to summarize and analyze data.

Development and Design of the Web Site

Because of the short time period for the project (nine weeks) and the instructor's limited experience using the internet, a decision was made early on to design a site that supplemented the course as it was currently being taught. This provided a base from which specific in-class sessions could then be converted for delivery online. The basic structure for the site was derived from existing web courses that the instructor had browsed. For the instructor with a limited knowledge of the internet, searching for example sites that can be adapted to one's own course can be a valuable starting point. The main idea for the site described here was a hyperlinked course schedule, adapted from the syllabus of a course in multicultural education (http://picce.uno.edu/SS/EDCI4620/SP984620syl.html#Calendar). Based on this concept, a web site was designed that included a main home page and a course schedule with links to individual units. The advantage of this layered approach is that it provides a mechanism for added security once the course is delivered online. Whereas access to the course materials could be limited (password protected) to students who have enrolled in the course, browsers who were interested in the course could still obtain general information about the course content and requirements.

Basic Design

The home page for the course's web site () resembles the course syllabus and provides general information about the course objectives, organization, and evaluation. *Course procedures and polices* are placed on a separate page and linked to the home page. The *Schedule* page, also linked through the home page, provides a tentative class schedule with a list of topics or units for the current semester. Hyperlinks to the individuals units are included on this page. The individual units were based on the materials in the instructor's course pack which included: unit objectives, study guide questions to accompany the reading assignments, quizzes, lecture outlines, in-class activities, and additional resources, such as practice problems and links to other sites. For the first iteration of the web site, not every unit had every element, but the site was built with placeholders for these elements, allowing for easy upgrading at a later date. It is important for a web site to be designed with maintenance in mind, as the web is a dynamic environment and the optimal web design will result from fine-tuning and several iterations (Schlegel, 1996).

Originally, the course was divided into 18 units, essentially one unit per chapter of the course textbook, Thorndike's (1997) *Measurement and evaluation in psychology and education*. The schedule was later revised into 11 units based on the topic rather than the chapter, roughly one unit per class meeting (excluding exams). This resulted in a less cumbersome schedule that could be easily modified from semester to semester and the creation of the appropriate units of instruction for future development of a completely web-based course.

Other components to the site include a resource page which provides links for downloading the course pack, resources for individual units, and other useful material. A *Student Information Form* was added to the home page for students to complete online. This page was also edited after the first iteration to be more generic with less information that would have to be changed each semester. Technical requirements and an *About this Site* page were also added to provide the user with information about how to navigate the site, an important aspect of web sites which is often overlooked. The design also includes a discussion board where students can post questions and comments, although this aspect of the site is not yet operational.

Online Activities

Each unit includes a quiz designed to help the student test his or her comprehension of the reading material. These quizzes were originally administered in class at the beginning of each session During the summer there was one online quiz; all were online by the fall semester. Each quiz consists of five to fifteen objective questions for automatic easy scoring. Students' completed quizzes are scores electronically and the results are emailed to the instructor. The student receives immediate feedback regarding his or her own performance, as well as the correct answers to each item. Although quizzes are scored, a student's grade for this portion of the course is based on the number of quizzes the student attempts, not on the actual quiz grade. This provides the student an incentive to complete the reading assignment but eliminates any possible anxiety associated with taking a quiz. Since many students enrolled in a statistics courses experience something akin to math anxiety, it is important to provide learning experiences that decrease rather than increase students' stress levels.

Once the basic structure of the web site was in place, the instructor and web developer could begin to convert individual units for online delivery. The first to be converted was the unit on test construction. This unit includes guidelines for constructing tests and writing test items. In place of a class lecture, materials to supplement the reading assignment were placed online under *Class Materials* for that unit. The item writing assignment that accompanies this unit was translated to be similar to the online quizzes. There are two parts to the assignment: (a) a set of objective questions that askes the student to evaluate a series of test items, and (b) a set of text blocks for the student to practice writing test items. The assignment was programmed such that the objective items are automatically scored, and then emailed to the instructor for further feedback on the written part.

Future development of the site as a web-based course was an integral part of the design. For example, the *Study Guide Questions* could possibly be converted into an online class discussion area or chat room. The lecture outline under *Class Materials* might be converted into an interactive information presentation accompanied by audio of the instructor. Various in-class activities, such as worksheets calculating basic descriptive statistics, can also be programmed as an interactive online activity, designed to provide the students feedback as they progress through the activity. One difficulty with such activities, however, is diagnosing student errors and providing sufficient feedback that will benefit the student. Such activities also require a significant amount of time on the part of the faculty member and the web developer to design and contruct.

Assessment

In the same manner that in-class quizzes provided the instructor with feedback on student progress, the online quizzes are also utilized as a method of formative evaluation throughout the semester. Such quizzes do not, however, provide any feedback on student progress after the class lecture and other in-class activities have been completed. One option is to place the quizzes at the end of the unit, after the in-class meeting rather than before. Once the course is converted to be delivered online, this approach may allow the instructor to better monitor student progress that was previously observed in the classroom. The use of an online discussion board as described above would also allow the instructor to monitor students' questions and comments. Students can also interact with the instructor directly through email. Both of these options, however, must be initiated by the student. In many cases, students are hesitant the bother the instructor with a "dumb" question. Building a rapport with the students through some on campus meetings may help to promote more online interaction (Fetterman, 1998).

Summative evaluation of student performance in a web-based course is also likely to differ from traditional assessment procedures (i.e., paper and pencil tests) typically employed in the classroom. This is particular true for statistics classes where the emphasis may be placed on application rather that content acquisition. Objective and short answer tests could be delivered online with the appropriate security precautions, similar to the online quizzes. A disadvantage to this approach, however, is that such assessments essentially become open book exams and may not be an adequate evaluation of student achievement in the course. Exams could be administered on campus, but this would in some ways defeat the purpose of an online course. A more appropriate approach to assessing student performance might be a series of performance tasks, more commonly referred to as authentic assessment tasks. Examples of appropriate tasks for a course in educational statistics and measurement are: a written report presenting the results from an analysis summarizing a small sample data set; constructing and pilot testing an instrument; developing an authentic

assessment task within the student's own field of education; and, locating and reviewing a published test. As with any assessment process, such tasks would need to be carefully constructed and well validated.

Technical Considerations

Based on the developer's previous experience with web development tools, *Microsoft FrontPage 98* was selected as the software tool for developing the course web site. This tool works well for fast development of a web site, and has excellent site management and publishing tools. For future development of more sophisticated interactive elements, other web course authoring tools might need to be considered, such as *Macromedia's Authorware* or *Asymmetrix's Toolbook II Instructor*. For the online quizzes, the developer chose to write a simple CGI (Common Gateway Interface) script using the Perl programming language. However, unless development support is made consistently available to the instructor, a web course development and management system with an automated quiz generation function would be more useful to the instructor for editing and generating online quizzes.

With regards to the design of the web site, a conscious decision was made not to develop a site that was graphic intensive. In order to keep download times to a minimum, no large images or image maps were used. Instead, clip art of about 2K in size was used for icons throughout the web site. This is an important aspect of designing a web site when one considers that not all students may have access to the latest browsers and/or most sophisticated equipment. For example, students with slower modems may become frustrated at the time required for graphic intensive pages to load. Such frustration can have a negative effect on the student's perception of the site and, more importantly, detract from the learning experience.

It is important for developers to keep in mind that there are two target audiences for two distinct types of web sites. The first are those students taking the course campus and utilizing the web site as a source for supplemental activities and materials, such as the site described here. For these students, the technical requirements for accessing the site should be lower (e.g., older browsers should be allowed). For courses that are primarily web-based, students may be required to have the latest browsers or plug-ins, for example, so that more sophisticated types of interactions could be incorporated if needed. Thus, an important part of the development process is recognizing the technical requirements not only for the instructor but for the student as well. Developers need to remember when developing and designing instruction, the use of technology should be secondary to well-designed learning goals and objectives (Berge, 1996).

Evaluation of Web Site

Student Feedback

A brief survey was conducted at the end of the summer to obtain feedback from students enrolled in the course. There were 19 students who completed the course. Of those, 18 completed the survey. Although these numbers are small and have limited generalizability, the results did provide some useful insights into the future development of the web site. Overall student response to the Web Site was very positive Many students were apprehensive at the beginning of the summer session, experiencing what McGonigle and Eggers (1998) describe as the initial stages of confusion and shock students have when taking a web-based course. Once this initial fear was overcome, the majority of students were excited about the web site and found that it enhanced their learning experiences in this course. One student commented, "Please pass the word that the convenience and comfort of the courses on the Internet are exciting!! It can possibly "de-stress" the lives of those of us who have long work hours and family commitments. The ability to access the course work online at my convenience yet with a due date in mind was fabulous!!"

The majority of students indicated that they liked having the course materials available over the internet. As one student stated, "If additional material was needed, it was made available on the web site in a timely manner. I did like the ease with which the material could be down loaded." Some students did experience difficulty down loading the materials. This was partly related to students' inexperience with the computer and the type of materials. (Graphic material and special symbols did not always translate across platforms.) Student responses to the design of the site were also positive and compared favorably to other university course web sites, both in terms of the quality and quantity of materials. Students also liked the images on the Web Site. In some of their written comments regarding the site, students noted that the site "was easy to navigate through" and "very well organized."

Only two students indicated that they did not like taking the quiz on-line. Other students commented that they liked the immediate feedback and would like to see all of the quizzes on-line. The majority of students

also felt an on-line discussion group would be useful. Many felt that it would be helpful to be able to talk with other students, particularly if the instructor was not available or they felt uncomfortable asking the instructor questions. Others felt that access to computers would hinder this and preferred person to person interaction.

Students were also asked if they would prefer an Internet-based course with at least half of the sessions online or a classroom based course. Eleven students preferred the internet course, primarily for reasons of convenience and having to commute long distances. Those students who preferred a classroom based course cited feeling more comfortable with face to face communication and lack of knowledge/experience with the internet and technology.

Conclusions and Recommendations

One approach to converting classroom based courses to be delivered via the Internet, and the one the was adopted here, is to first develop a site that serves as a supplement to the in-class course. Something as simple as an online syllabus can be advantageous for the student and the instructor, where it becomes a gateway for all course information (Mitchell, 1996). The idea of starting with a web site with only supporting materials may work well with faculty who are not familiar with the Internet, or those who do not have the time to embark on a complete conversion of their classroom based course to a web-based one. It allows the faculty member time to get use to using the web with their current familiar classroom materials, rather than having them try to get comfortable with the web at the same time that their course is being redesigned for web delivery using a different model of instruction. A side benefit to this approach is that the instructor is required to thoroughly examine and organize his or her current materials, which may lead to improvements in the classroom based course. Establishing a site as a supplement to the classroom based course may also help students to become more comfortable with the internet. This is an important consideration for programs such as this one where the students are typically older (average age 32) and have limited experiences with the rapidly growing field of instructional technology.

The growth in web-based courses has been quickly followed by an abundance of resources and guides for educator on how to develop such courses (e.g., see Khan, 1997; Porter, 1997; Robin, Keeler & Miller, 1997). The challenge for the individual instructor is apply what can be an overwhelming amount of information to their specific courses. The are several steps that can be taken by universities to support faculty wishing to undertake this endeavor. The first is to provide faculty training. Faculty members need to be aware of what types of technology exist and what university support will be available to them. Some basic faculty training topics related to instructional design and development could be presented in the form of on campus workshops or even as web-based lessons. Providing training online would have the added benefit of allowing faculty to experience web-based instruction.

To ensure consistent and continuous support of faculty for web-based projects, an instructional design team should be created as a permanent university entity. This group would consist of instructional designers/developers who would act as in-house consultants to faculty, providing support for web-based course design and development. This team could be made up of a combination of university instructional design staff and graduate interns from an Instructional Technology program within the university. These "consultants could sit in on lectures, offer advice for more interactivity, think of ideas for work group activities, assist the instructor with creation of presentation materials, or train faculty in the creation of these materials.

Finally, in the commitment to provide students with quality educational experiences through a variety of media, universities must also recognize the support and training students will need to be successful in such courses. Students should have training made available to them on such subjects as how to take an online course, how online courses are different from classroom based courses, what skills are needed to be good online students, etc. Many School of Education programs require students to take a core course in instructional technology. Such a course can serve as a mechanism for providing student with the training and knowledge they need to successful engage in online courses.

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Issues in the Undergraduate Mathematics Preparation of School Teachers: A World Wide Web Site

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Here in we introduce a *World Wide Web* site titled *Issues in the Undergraduate Mathematics Preparation of School Teachers.* <*www.k-12prep.math.ttu.edu*> This site is dedicated specifically to issues involving the college level mathematical preparation of prospective K-12 teachers, with the target audience being faculty members and administrators at institutions of higher education who are interested in the mathematics preparation of this group of students.

The site consists of four components: a refereed journal, a discussion group, a technology area, and a catalog of links to related sites. It is intended to provide a resource center, for the dissemination of the research results, insights, and ideas of professional educators and mathematicians on the wide variety of issues pertaining to the college level mathematics preparation of future K-12 teachers.

The site contains descriptions of the philosophies underlying the development of each component. Also it contains solicitations for contributions, with appropriate "information for contributors" provided.

How to Incorporate Spreadsheets into Classes Other than Mathematics

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Abstract:
Many people identify spreadsheets with just tables of numbers used in financial statements or in keeping track of expenses at home and the work place. Other people use it as a powerful tool for other purposes. Teachers should be no exception. They can enhance their teaching by incorporating spreadsheets into their subjects. This paper shows opportunities for this purpose.

Introduction

Teaching can be more effective when teachers use spreadsheets in their classes. Beyond this specific purpose, benefits can trickle down towards other objectives either academic or non-academic. Spreadsheets are powerful tools in college, at home, and in the workplace. All these benefits can be rooted in the early use of spreadsheets in elementary, secondary, and high school. This paper identifies some of these uses.

Spreadsheets

What is a Spreadsheet?

A spreadsheet is a rectangular array of boxes in rows and columns. Its columns are named by letters (A, B, C, etc.) and its rows by numbers (1, 2, 3, etc.). Each individual box in the array is called a cell.

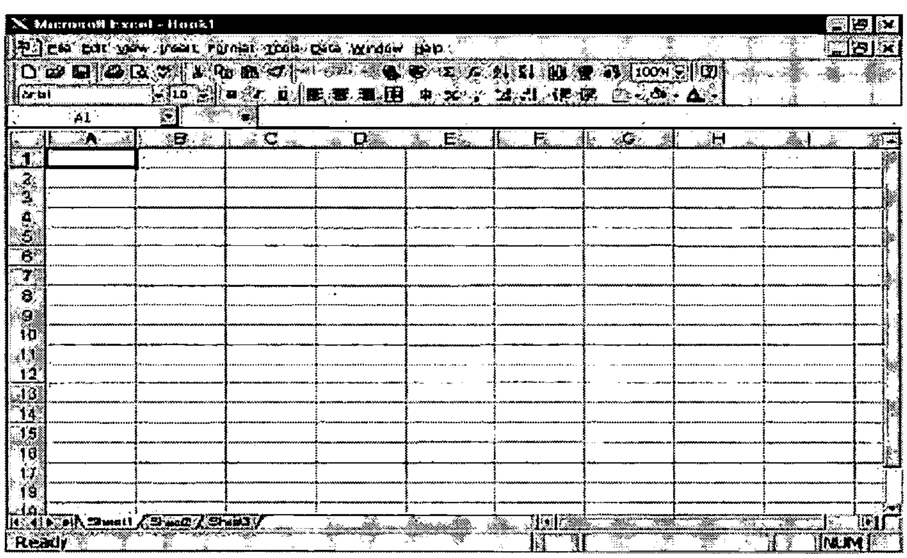
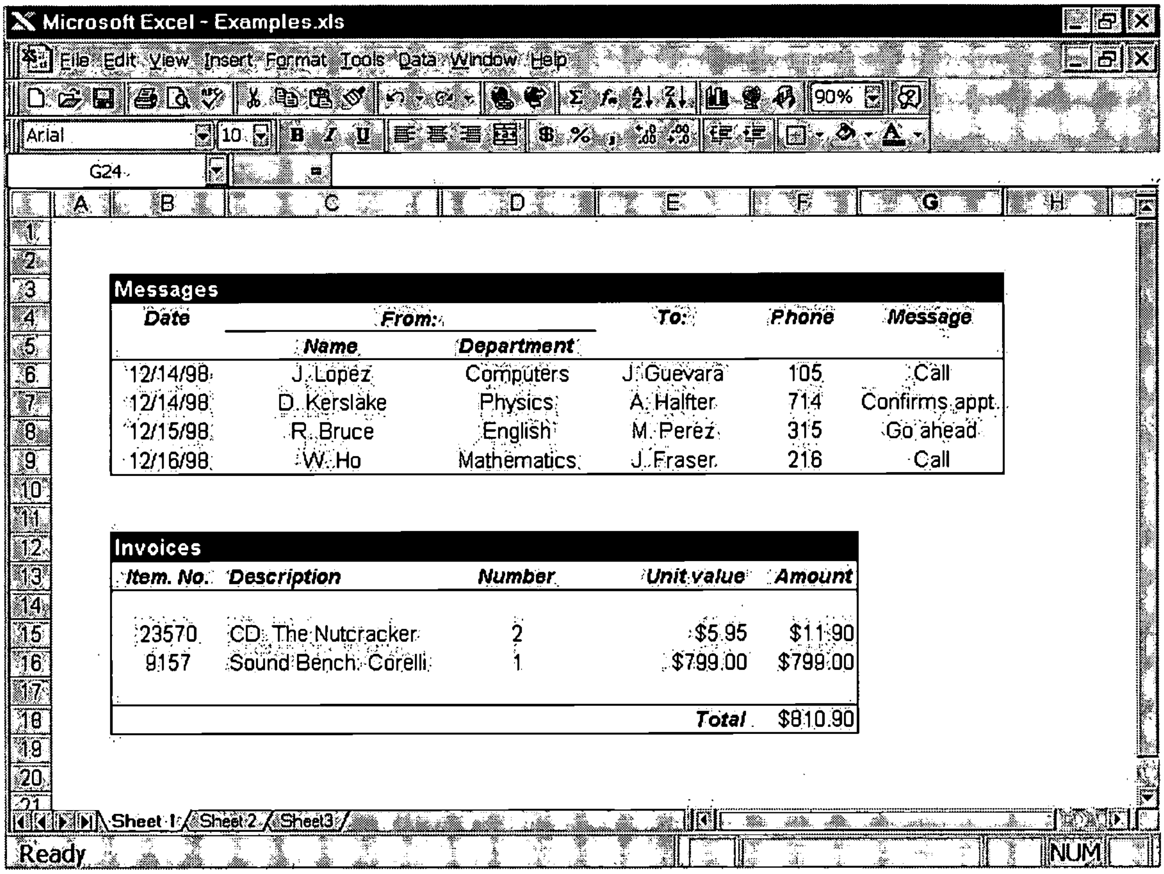


Figure 1. A Spreadsheet

The maximum size of a spreadsheet depends on the program used and the computer's memory. Excel, for example, can manipulate tables with up to 256 columns and 65,536 rows. Mathematical, logical, sorting, and graphical operations can be applied to the values stored in cells. A cell contains text or non-numeric information, numbers, formulas, dates or times.



Messages

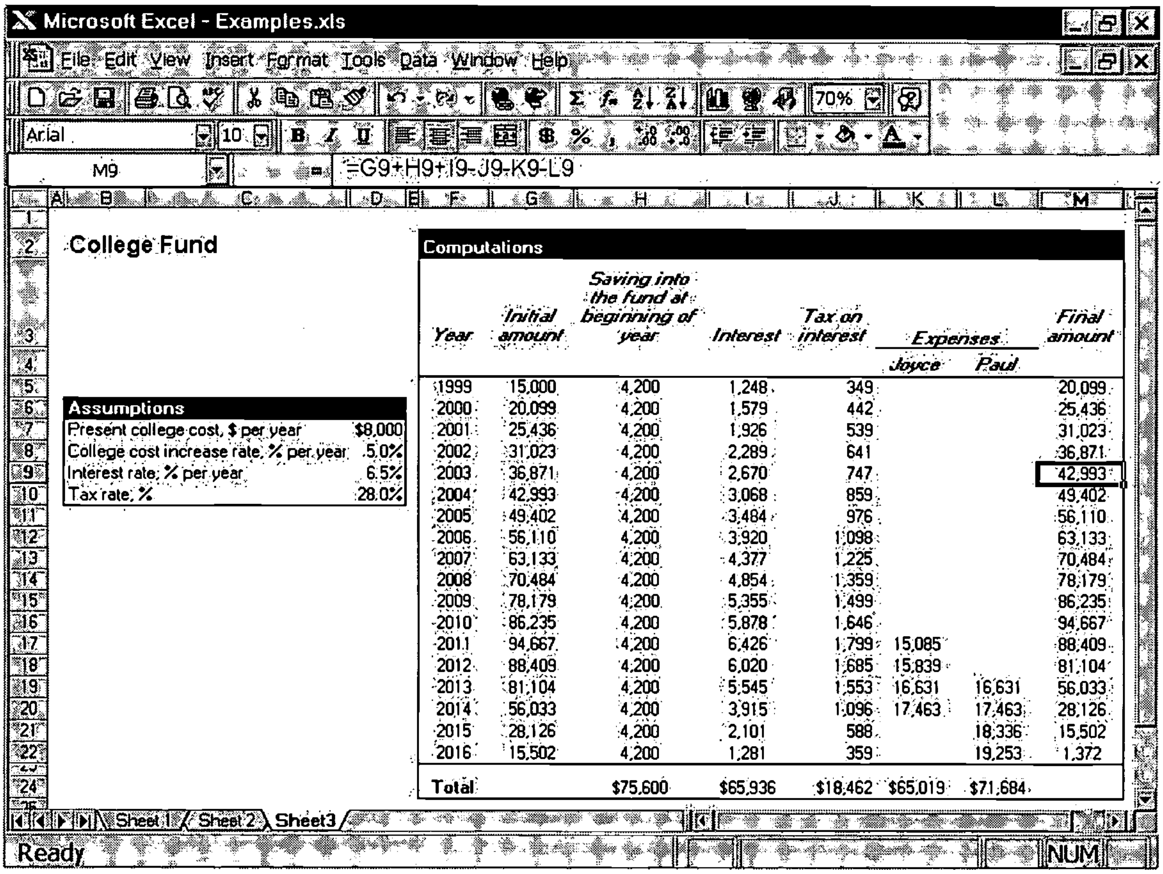
Date	From: Name	From: Department	To:	Phone	Message
12/14/98	J. Lopez	Computers	J. Guevara	105	Call
12/14/98	D. Kerslake	Physics	A. Halfter	714	Confirms appt.
12/15/98	R. Bruce	English	M. Perez	315	Go ahead
12/16/98	W. Ho	Mathematics	J. Fraser	216	Call

Invoices

Item. No.	Description	Number	Unit value	Amount
23570	CD: The Nutcracker	2	$5.95	$11.90
9157	Sound Bench: Corelli	1	$799.00	$799.00
			Total	$810.90

Figure 2. Example

Spreadsheets are useful to determine consequences in "what if" situations: What happens to profitability if prices go up or down? How much has to be saved into a retirement fund if interest rates go down or inflation goes up? What saving rate is needed if college costs increase? And, for the students, if the prices go up a certain percentage how much more allowance should they ask their parents?



Assumptions	
Present college cost, $ per year	$8,000
College cost increase rate, % per year	5.0%
Interest rate, % per year	6.5%
Tax rate, %	28.0%

Computations							
Year	*Initial amount*	*Saving into the fund at beginning of year*	*Interest*	*Tax on interest*	*Expenses*		*Final amount*
					Joyce	*Paul*	
1999	15,000	4,200	1,248	349			20,099
2000	20,099	4,200	1,579	442			25,436
2001	25,436	4,200	1,926	539			31,023
2002	31,023	4,200	2,289	641			36,871
2003	36,871	4,200	2,670	747			42,993
2004	42,993	4,200	3,068	859			49,402
2005	49,402	4,200	3,484	976			56,110
2006	56,110	4,200	3,920	1,098			63,133
2007	63,133	4,200	4,377	1,225			70,484
2008	70,484	4,200	4,854	1,359			78,179
2009	78,179	4,200	5,355	1,499			86,235
2010	86,235	4,200	5,878	1,646			94,667
2011	94,667	4,200	6,426	1,799	15,085		88,409
2012	88,409	4,200	6,020	1,685	15,839		81,104
2013	81,104	4,200	5,545	1,553	16,631	16,631	56,033
2014	56,033	4,200	3,915	1,096	17,463	17,463	28,126
2015	28,126	4,200	2,101	588		18,336	15,502
2016	15,502	4,200	1,281	359		19,253	1,372
Total		$75,600	$65,936	$18,462	$65,019	$71,684	

Figure 3. "What if" situations

Main Uses of Spreadsheets

Problems that are iterative, recursive, or tabular are well suited for spreadsheets. They provide the means teachers and students need to fool around with the "what if?" questions that emerge in the problem solving process. They enhance the user's insight into the development and use of algorithms. The use of spreadsheets frees students of tedious numerical manipulations, allowing them to concentrate on the mathematical problem. They permit students to see a progression of calculations, on the computer screen. Spreadsheets also allow students to change the values of variables, one at a time, to observe the outcome of the operations performed with the variables.

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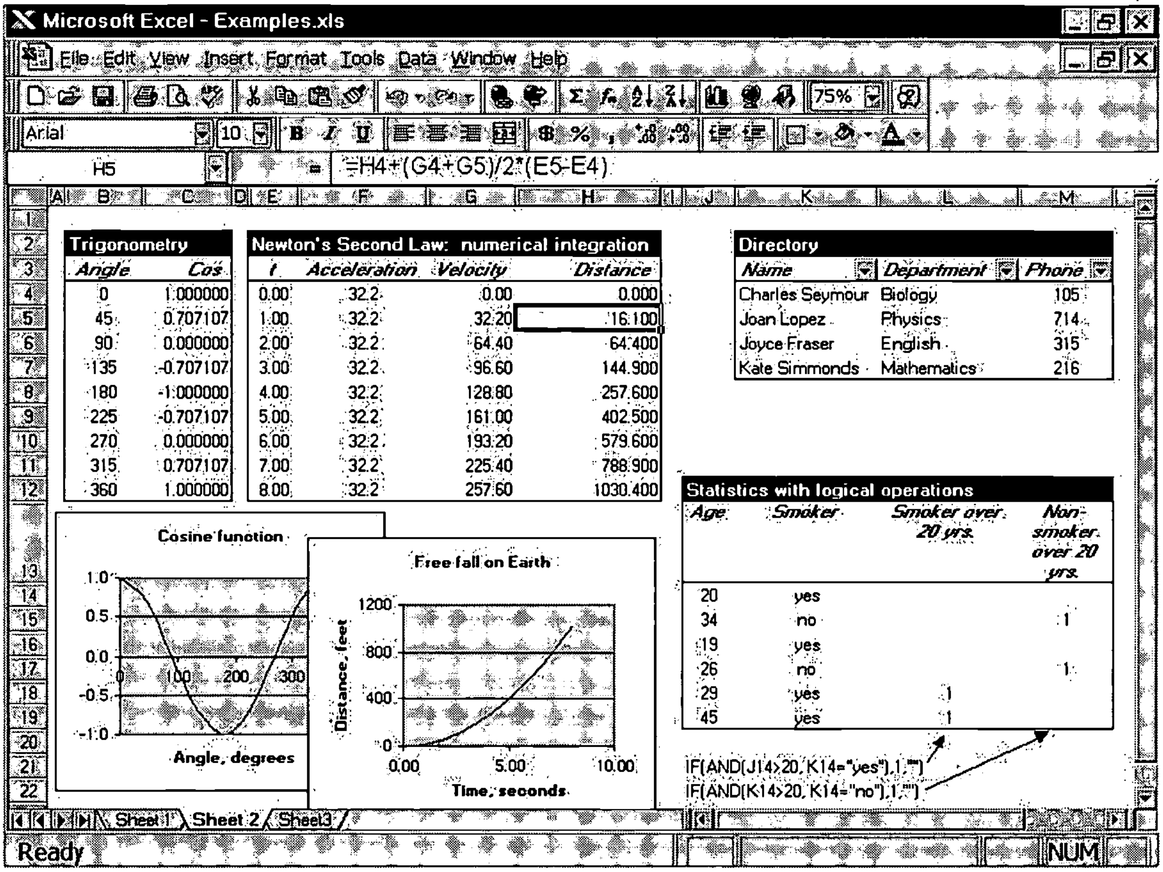

Figure 4. Mathematical, Logical, and Graphic Functions

Spreadsheets in the Classroom

Spreadsheets can be used in different subject areas, such as English, Languages, Social Studies, Sciences, Physical Education, and Mathematics. Next some applications are identified.

Subject	Applications
English and other Languages	Match words and pronunciations, words and translations, verb tenses, words and meaning. Find number frequency in ciphering codes.
Social Sciences	Describe natural resources size and relative distribution: classify countries by size of farmland, mountains, lakes; compute percentage of these kinds of areas. Relate demographic and socioeconomic variables and describe their dynamics: compute population distribution in cities, rural areas, small towns, and percent literate versus decade or ethnic backgrounds. Relate socioeconomic variables: economic growth, that is, crops or mining or shipping or roads; or the growth of industrial, farming, and services in general. Comparing the buying power or cost of living in different areas, and projecting growth rates. Find saving rates needed to fund college education and retirement pensions. Keep track of exchange rates.

Subject	Applications
Natural Sciences	Change units of temperature, mass, length, area and volume. Describe monthly and yearly frequency of storms in different areas. Compute distance, velocity, and acceleration of falling objects on Earth by numerical methods to illustrate Newton second law. Compare planets in the solar system: mass, velocity and distance from the Sun. Describe monthly distribution of rainfall, growth of plant or animal under different experimental conditions, rainfall intensity, and latitude. Simulate growth and decay of animal populations.
Physical Education	Graph score times of specific track and field events; keep track of the number of push-ups and sit-ups a student can perform on a sequence of days; keep individual and team records; and run simulations of events and games.
Mathematics and Statistics	Compute areas and volumes. Graph histograms and continuous variables. Graph equations. Estimate equation's parameters empirically and forecast values of dependent variables using values of independent variables.

Table 1. Selected Applications

Extensions

Teachers can also use spreadsheets for other purposes:

- academically related, scheduling, attendance, keeping a grade book; and
- non school related, keeping track of bank statements, checkbooks, phone bills, drawing floor plans and playing games such as battle ship.

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Using Pre-test/Post-test Data to Evaluate the Effectiveness of Computer Aided Instruction

(A study of CAI and its use with Developmental Reading students)

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Abstract: As Computer Aided Instruction and Distance Learning become more popular, a model for easily evaluating these teaching methods must be developed, one which will enable replication of the study each year. This paper discusses the results of a study using existing pretest and posttest data to evaluate CAI for developmental reading students.

Introduction

Texas Southmost College in partnership with The University of Texas at Brownsville (UTB/TSC) serves approximately 10,000 students in a large portion of the Lower Rio Grande Valley in the southern tip of Texas. Because of the open enrollment policy at TSC, many UTB/TSC students enter college with deficiencies in reading ability, in mathematics competency, or in writing skills.

Beginning in 1988, the state of Texas mandated the Texas Academic Skills Program (TASP) for all new college students. If a student does not pass the reading, mathematics and writing portions of the TASP he/she must take developmental courses until each portion of the TASP is passed. Approximately twenty-percent of the 62,731 semester hours taken by TSC students each semester are in developmental courses (20.1% in Spring, 1997).

The cost of developmental reading courses is high. Classes must be small so the teacher will be more available to the students. Teachers must be trained in developmental reading. Every faculty member was teaching several developmental reading classes, and many adjunct-faculty also were hired. Even with small classes, the success rate of developmental reading students was low. UTB/TSC has been seeking ways to improve the success of students in developmental courses, but also to lower the costs of developmental training.

Computer Aided Instruction can be justified on a financial basis in today's world. After an initial investment, a large number of students can be served on a continuing basis with CAI. Some studies have shown that CAI is successful, but other studies have shown that CAI is not always successful. There are reasons to believe CAI will be a satisfactory substitute for traditional developmental courses at UTB/TSC:

- Students working in CAI will be able to work at convenient times.
- Students taking developmental reading by Distance Education will be able to work at convenient times without the necessity of commuting.
- In CAI students are pre-tested and a personalized course of study is prescripted for each student.
- In CAI a student can work at his own pace.
- In CAI students will spend their time on skills they need to learn.
- In CAI students will have tutorials, practice exercises, and tests over each skill.

TASP exam results for CAI students have shown that CAI is approximately as successful as the previous results from instructor-led courses, but comparisons between the two methods have been disappointing. CAI has been allowed to continue, mostly because some of the problems with the computer lab are solved each semester.

CAI has proven to be a cost-effective way of providing developmental reading. Students enter developmental reading at many different levels, so traditional teaching of developmental courses was a

complex and cumbersome task. Each student in CAI is scheduled for three hours weekly in a large computer lab. Peer tutors and faculty are available if students need help. More than 100 computers are busy most of a 14-hour day. Since the computer administers placement tests, and prescribes which modules a student will need to complete, the CAI Lab is called Computer Directed Instruction (CDI).

Need for the study

A study by the National Center for Developmental Education (NCDE, 1996) found that the quality of remedial courses provided in support of the TASP test varies widely from college to college. The study stated:

> Ongoing and systematic evaluation of the outcomes of remedial courses and programs is rare. Although there is a strong emphasis on compliance with TASP regulations among Texas colleges and universities there is little emphasis on accountability for the outcomes of TASP remediation" (Boylan, 1998).

As CAI becomes more popular, a method for studying the effectiveness of CAI must be developed, one which will allow replication of the study each year.

Problems with using an experimental model for evaluation

A randomized experimental model with two groups, if it were possible, would not provide causal inferences that meet the needs of the policy planners. Next semester's students are not part of the population studied, and there is no scientific justification for applying causal inferences to them. Only after several semesters of replication, could common inferences be applied to similar populations (as long as the labs are similar and the students are using the same CDI software).

True experimental studies in an educational setting are seldom acceptable. The experimental process would require the researcher to schedule random samples from the entire population of developmental reading students and to place them into control and experimental groups. The researcher would have to control all factors affecting the student's schedule (work, other classes, family responsibilities, commuting, etc.).

There are multiple variables affecting these developmental students in their first semesters at college. All of these variables affect their progress in developmental reading. Achen describes the idiosyncratic behavior as a function of the history and personality of the humans studied:

> Any realistic data set involves a hopeless jumble of human actors, all engaging in idiosyncratic behavior as a function of numberless distinctive features of their histories and personalities. Many thousands of details of their individual histories contribute to their behavior (Achen, 1992, p. 25).

Achen continues, "Functionally correct causal specification in social science is neither possible nor desirable" (Achen, 1992, p. 25).

Problems with using a quasi-experimental model for evaluation

Quasi-experimental studies are commonly used in the educational setting. In a quasi-experimental model, students are allowed to choose their classes, and then some classes are assigned to the control group and others to the experimental group. Because no random assignments are made in quasi-experimental research, the samples are not representative of any population. After a quasi-experimental study, some combination of other factors, such as pupil or teacher satisfaction (or cost), are usually relied on to determine whether or not to continue using CAI. Indeed, a quasi-experimental study cannot result in a determination that CAI provides the best teaching method for teaching future students, or even for teaching the current population. The benefits of the two-group method used in the quasi-experimental mode are overshadowed by the dynamic nature of computer software and CAI instruction.

The developmental reading computer lab at UTB/TSC has gone through many changes and has been expanded. The DOS-based PLATO software, developed in the 1960's by Control Data Corporation and the University of Illinois, was expanded by upgrades, and improvements were added several times during the two years of use. A new Windows-based software package, "Destinations" was selected in 1996. A brief summary of events during this study shows the fallacy of applying causal inferences to future CAI labs:

- First semester--too few computers, long lines of students unable to get computer time.
- Second semester--better scheduling of computer time but no way to enforce time-on-task.
- Third semester—better scheduling of computer use, but the lab suffered for a month because a hacker kept erasing student data files.
- Fourth semester--few problems this semester, but no faculty involvement and no peer tutors.
- Fifth semester--entirely new software package, new lab, better scheduling.
- Sixth semester--more peer tutors and teachers hired.
- Seventh semester--major upgrade in the CAI software, network problems resulted in rewiring the lab network.
- Eighth semester--less problems but more software upgrades.
- In 1999, upgrade to a new Internet-based software delivery.

Software upgrades, the addition of peer tutors, changes in scheduling methods, and many other factors kept changing each semester. Which of the changes were effective and which were not? UTB/TSC needs an evaluation model that can be used to *continually* evaluate the success of CDI. The count of the number of students completing the reading portion of the TASP exam does not provide enough information to properly evaluate the effectiveness of a required program which accounts for approximately twenty-percent of UTB/TSC student's total semester hours.

The costly control-group/experimental-group would have to be repeated each semester to provide needed information for administrators. Results from such research could not justifiably be applied to make inferences about the next semester.

Determining a research model is the first step in a deeper study of the effectiveness of CAI/CDI as a teaching tool for developmental reading. According to Fox (1997), "Statistical models are capable of capturing and describing that structure, or at least significant aspects of it." (Fox, 1997, p. 5)

Using a statistical control model for evaluation

For the purpose of this study correlation does not provide enough information about the relationship between variables. It is not enough to say that a correlation exists between the variables being studied. As Elizabeth Cohen describes the problem: "We need to construct a more powerful statement for an ideal policy proposition, one using something similar to the following form: if we vary x, then certain predictable changes will occur in y." She continues, "This proposition requires no less than an effective understanding of how the two variables come to be associated" (E. Cohen, 1970, 28-29).

Further, changes (hopefully, "improvements"), were made each semester in the way CAI and then CDI were applied: more computers, more tutors, better software, and many other "improvements" were made each semester.

Statistical control can provide a means for studying the success of CAI and distance learning without creating an artificial environment for developmental students. Statistical control and its value is described by Pedhazur in the following paragraph:

> Statistical control means that one uses statistical methods to identify, isolate, or nullify variance in a dependent variable that is presumably "caused by one or more independent variables that are extraneous to the particular relation or relations under study. Statistical control is particularly important when one is interested in the joint or mutual effects of more than one independent variable on a dependent variable because one has to be able to sort out and control the effects of some variables while studying the effects of other variables. Multiple regression and related forms of analysis provide ways to achieve such control (Pedhazur, 1982, p. 98).

Since all students take a placement exam before they enroll in developmental reading and the TASP exam after they have taken developmental reading, these measures can be statistically adjusted to

provide pretest and posttest observations. The CAI software keeps track of the time that students are working exercises in CAI. These variables can be used to answer the question, "Does a reasonable amount of time-on-task in CAI prepare developmental reading students for successful completion of the TASP exam?" The following variables can be used to develop a statistical model for evaluation of CAI.

Dependent variables--*pretest* and *posttest*: In this study, reading score on the TASP exam is the posttest measure. Pretest measures were either the Nelson-Denny Reading Test Form E or the ACT-ASSET test, which replaced the Nelson-Denny in the Fall of 1995.

Independent variable--*time-on task in CAI*: Time-on-task in the CAI experience is used as the experimental variable. The variable used in this study will be the measure of time the student spends working in the CAI reading program. Although many other school experiences help the student learn to read, students spending more time using the CAI program will also receive more benefit from other school experiences. Time-on-task in CAI will be used as a measure of the "CAI experience".

The research model for this study will be a single-group, pretest/posttest model using multiple regression to assess the relationship between the time-on-task in the CAI experience and progress in reading as shown on the TASP exam. The results are determined by comparing the pretest score to the posttest score. This study will be replicated for a period of eight semesters using eight populations and two different CAI programs to determine if results are consistent. Results from this study will be described in this presentation. The research hypothesis is *"Students who spend more time-on-task in CAI will make better score gains when they take the TASP exam than students who spend less time-on-task in CAI. "*

Why use multiple regression?

Multiple regression provides a method for statistically controlling for multiple factors affecting reading progress, and for developing predictive equations useful in evaluation of CAI. In this study, multiple regression analysis is used to provide a scientific explanation of something that has happened, rather than to forecast the future. Although causal inferences cannot necessarily be developed from a regression analysis, such an analysis does make possible a meaningful statistical interpretation of the relationship between variables

Kleinbaum and Kupper state that MRC (Multiple Regression/Correlation) can be used, "To describe the extent, direction, and strength of the relationship between several independent variables and a continuous dependent variable" (Kleinbaum & Kupper, 1978, p. 11). They continue, stating that multiple regression analysis is a general technique, which can be used with all kinds of variables (Kleinbaum & Kupper, 1978, p. 14). Cowen and Cowen describe the process,

> The basic strategy of the analysis of causal models is first to state a theory in terms of the variables that are involved and, quite explicitly, of what causes what and what does not, usually aided by causal diagrams. The observational data are then employed to determine whether the causal model is consistent with them, and estimate the strength of the causal parameters (Cohen & Cohen, 1983, p. 14).

Limitations of the study

The one-group, pretest-posttest design chosen for this study has several limitations that must be considered. The pretest-posttest is used to rule out selection as a rival explanation, but Kidder lists the five other threats to the internal validity of the one-group, pretest-posttest design. The threats are (1) history, (2) maturation, (3) testing, (4) instrumentation, and (5) interaction of selection and maturation (Kidder, 1970, p. 45). These five rival explanations are potential threats for any study using the one-group, pretest-posttest design and they will be ruled out, in part, by limiting the conclusions from this study. Each of the rival explanations is described below.

History. The posttest is not taken until several months after the pretest (perhaps even a year or two later) so part of the difference between the posttest and the pretest may result from the different social climate. The student is now a college student, pressured to study (and to read effectively) by faculty in other

courses. No meaningful study of college reading effectiveness would want to isolate the student from the rival explanation of history. Such a study would require an artificial environment for the student, and could test only some small part of CAI instruction.

This study seeks to include the effects of history as a part of the student's success in developing reading ability (as judged by the TASP exams). The study does not seek to isolate CAI as a separate variable, but will use as a variable "the CAI experience", which includes CAI and college experiences (history) during the time the student takes developmental reading. History is not a rival explanation, but is a part of the variable being studied.

Maturation. Certainly new college students are maturing during the first year or two of college. They have become independent in many ways after leaving high school--some are working, some are married, and most have less family control over them. They have become responsible for their own learning like never before. Maturation is an important factor in college success. Like history, maturation becomes a part of the variable being studied in "the CAI experience" and the researcher does not seek to isolate it for the purposes of this study. Maturation is not a rival explanation, but is a part of the variable being studied.

Testing. The tests taken in this study are required for every student entering college. Certainly the pretest will affect the developmental student because he failed to make an acceptable score on the test. The pretest shows the student that he needs to acquire additional reading skills. Tests are used in a prescriptive way in CAI, helping the student to focus on skills he needs to learn. Testing is not a rival explanation, but is another part of the variable being studied in "the CAI experience".

Instrumentation. Different instruments are used for the pretest O_1 and the posttest O_2. These tests are not equivalent tests that can be subtracted to determine the student's gain in reading skills. Instead, transformation methods will be used to standardize the pretest and posttest variables. Dometrius describes the process, "The standardizing process first identifies for a case the deviation above or below the mean of the variable ($Y - \overline{Y}$) and then transforms that distance to standard deviation units (divides by S_Y)." He explains, "As in other transformations discussed earlier this change does not affect what the variable measures; it just modifies the scale used for the measurement" (Dometrius, 1992, p. 423).

Interaction of selection and any other threat to internal validity. This threat considers that the group selected may react to one of the other threats to internal validity in a way different from other groups. This threat will be controlled as much as possible by using a large sample, randomly selected from the population. Also, the statistics will be replicated for developmental reading student populations over a period of four years.

The weakest part of this study is from the threats to internal validity. The limitation of the project is described by Fox, "Although we can unambiguously ascribe an observed difference to an experimental manipulation, we cannot unambiguously identify that manipulation with the independent variable that is the focus of our research" (Fox, 1997, p. 9). McMillan explains that internal validity "refers to the extent to which the independent variable, and not other extraneous or confounding variables, produced the observed effect (McMillan, 1996, p.194).

It is inappropriate to consider any one or two of these approaches as superior to the others. The effectiveness of a particular methodology depends in large part on the nature of the research question one wants to ask and the specific context within which the particular investigation is to take place. According to Dometrius, we need to gain insights into what goes on in education from as many perspectives as possible, and hence we need to construe research in broad rather than narrow terms (Dometrius, 1992, p. 11).

Generalizability:

Since the populations studied are approximately ninety-percent Hispanic, and are in an isolated area of Texas, results of this study can not be generalized to other colleges until the study is replicated on the other campuses. However, because the study has been replicated on this campus with eight developmental reading populations, some conclusions can be generalized to the next population of developmental students at UTB/TSC with some degree of success.

Only after the model is tested in many schools and with different populations can any generalizations be applied with other populations. Fraenkel describes how a research model becomes acceptable in other situations by repetition: "Such investigations, however, do not constitute science unless they are made public. This means that all aspects of the investigation are described in sufficient detail that the study can be repeated by any who question the results..." (Fraenkel, 1993, p. 6).

This paper will discuss the results from using multiple regression statistics to evaluate the success of CAI at UTB/TSC in Brownsville Texas. Suggestions will be made for replicating the model to evaluate CAI in other schools. Statistics and conclusions will be posted on my web-site at: http://unix.utb.edu/~lansford

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Effectively Using Internet Data: New Horizons in Mathematical Modeling

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Abstract: Mathematics education is changing rapidly and the NCTM Standards, as well as new technological advances, give the mathematics educator new tools to help students become more math literate. Mathematical modeling can be a primary factor in the curriculum to help students discover patterns and consistencies in both numerical and geometric data that allows them to test, refine, and build generalizations. In addition, the modeling activities can be a natural extension of traditional problem solving activities and has much potential to have students work on real life situations.

Introduction:

Revolutions in mathematics education have come fast and with great force in the past decade, first with the NCTM Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989) and more recently with the great leaps in technology, specifically, great leaps related to Internet based technology. With these revolutions have also come great expectations for teachers to produce students who are more mathematically literate than they've ever been before. Yet with all of the provisions and pressure to produce, students are still not making the gains that would seem appropriate to outside observers. Although it would appear that these teachers have the newest in "standards" and wonderful technology, the instructional habits of today's educators would suggest that they are still armed with a less than up-to-date curriculum.

Mathematical modeling, in some form or another, seems to be one logical choice to help give the curriculum a much needed boost. The fundamental idea behind mathematical modeling is that students, through modeling activities, discover patterns and consistencies in both numerical and geometric data that will allow them to test, refine, and build generalizations by creating a "mathematical machine." This "machine" would provide them with a means for fairly accurate predictions that can actually be tested using data sets from the Internet. The modeling process however would typically go through several modifications or refinements in order to be more accurate, faster, or efficient.

Curriculum Infusion:

The premise of the mathematical modeling concept is not that the traditional courses in the curriculum need to be replaced, but rather accented in appropriate spots to better emphasize the practical use of the concepts we do teach. Internet based technology available in classrooms today allows for the kind of mathematical modeling activities that the NCTM originally intended to fall under the general headings of Problem Solving, Communication, Reasoning, and Connections. The primary reason that Internet technology makes this so much more plausible today than when the Standards were released in 1989 is that now, hundreds of problems that naturally fit current high school mathematics curriculums exist in very real settings at various locations around the world on the Internet. Nothing in the existing curriculum needs to be contrived into makeshift problem solving activities by the classroom teacher. Instead, massive data sets on topics ranging from U.S. Government labor statistics to personal web pages containing graphical information on endangered species are available at the touch of a button. Using these data sets and other applications for mathematical modeling purposes can graphically illustrate practical uses of common curriculum topics, such as finding the slope of a line or factoring polynomials. Perhaps the greatest challenge in this area is to convince teachers that carefully conceived mathematical modeling activities actually do much more to support existing curriculum topics than pages and pages of practice problems.

With the Internet continuing to expand at an exponential rate, educators may find themselves overwhelmed by electronic resources including lesson plans, databases, interactive simulations, and nearly limitless communication possibilities. It is this realization that gives good teachers cause to examine current uses of Internet resources in the context of their own mathematics curriculum and to decide what will be most beneficial to the students.

Why Mathematical Modeling.... Blooms Taxonomy: Old Topic, New Idea

Mathematical modeling, as a formal part of the mathematics curriculum, can be difficult to define and conceive; however, an old topic from pre-service teacher education training may be helpful. One of the primary guiding principles related to lesson planning and questioning in undergraduate teacher preparation is Bloom's Taxonomy. The six levels of Bloom's Taxonomy (knowledge, comprehension, application, analysis, synthesis, and evaluation) are typically used to assist teachers in defining levels of cognitive processing for their lessons. Although the topic of Bloom's Taxonomy is not a new one, a re-conceptualization of these six levels may help to put mathematics instruction in perspective as per the NCTM Standards. It is not unusual to see classroom teachers justifying lesson objectives by suggesting that they are designed to have students think at a given level. For instance, adding two fractions taken from student made measurements might mean they are operating at the "application" level. However, there appears to be confusion about what each level actually is. The lists of synonyms traditionally used to define the six levels don't always provide a clear understanding of how to write objectives that focus on different levels for a single mathematical topic. In fact, very few mathematics textbook problems go past the application level, which is why many teachers of mathematics find it difficult to stretch their objectives to fit higher levels of cognition. Even the textbook "problem solving" applications do not address the higher levels of Bloom's Taxonomy in the way the NCTM originally intended because the solutions to those problems typically follow a set of closely related practice exercises.

In revisiting the three higher levels of Bloom's Taxonomy (analysis, synthesis, and evaluation), we can provide for a way to rethink the NCTM Standards related to Problem Solving, Communication, Reasoning, and Connections, and by extension, mathematical modeling. In rethinking the Analysis and Synthesis levels of the taxonomy, one might find that they are appropriate levels of cognition for true problem solving activities in the way the NCTM originally intended. Problem Solving in its true nature assumes that the solution is not innately obvious, and that problem solvers need to follow a more general heuristic in order to come to a conclusion. There may also be numerous solutions to one problem, which again indicates that any specific algorithmic application is at a lower level of cognitive processing.

The highest level of Bloom's Taxonomy (evaluation) is perhaps the most difficult to define. Evaluation based objectives have typically done little more than superficially ask the question "Is this any good?" This is where mathematical modeling comes to the proverbial rescue. Math modeling is a multi-faceted process of *problem solving* (NCTM Standard #1) combined with stages of continual refinement. Evaluation as it pertains to mathematical modeling presumes a cyclical process whereby the student solves a problem to a reasonable extent using topical information from the classroom instruction, and then re-examines data to search for a way to make the solution better, faster, or more efficient. In essence, it is a continued *reasoning* (NCTM Standard #3) process that takes place even after an initial solution is reached. Students participating in mathematical modeling activities will be exposed to many different levels of "thinking mathematically." The application of specific mathematical processes is important but is secondary to the synthesis process, where they bring several algorithmic applications together to propose a solution to a broader problem. The model can then be added to as the students discover, or are instructed in, better ways to approach the problem.

Technology's Part in Mathematical Modeling

Graphing calculators, spreadsheet applications, simulation software, and even Java applications on the Internet are now available to a much greater extent than they were even five years ago. It is this fact that provides teachers everywhere the opportunity to incorporate mathematical modeling activities into existing curriculum

and to give their students a chance to use technology in a productive way. Real life problems related to optimization were normally not taught until calculus, but with the appropriate graphing technology, students at lower grade levels can learn to interpret and build mathematical generalizations based on graphical information provided by their calculator or spreadsheet. This exposure in the lower grades (i.e. algebra or geometry) would set the stage for much more meaningful problem solving when the same students reach calculus and study optimization as a formal topic.

Another common graphing application in most algebra classes has to do with finding slopes and axis intercepts of lines. Internet data, in many forms, can be used to help students build mathematical models that support this area of the mathematics curriculum. The United States Bureau of Labor Statistics web site is an excellent location for using the concepts of line graphing to make predictions and generalizations about the condition of the economy, income, cost of living, and worker productivity. In using traditional textbook based instruction related to finding and graphing critical points on a line, teachers can reinforce the value of computations in linear equations by providing the students an opportunity make predictions about various aspects of the labor force. For instance, using one set of data related to the number of hours the average worker spends on the job, students may note variations in the averages around December and November and conclude that Christmas shopping was the cause. They may also note that the relationship is otherwise linear with a slope very close to zero. Upon inspecting the average income among workers, they will observe a slight increase from month to month and perhaps surmise that this is the *slope* of the line. At this point, students would use what they have learned from the textbook to graph the line that best fits the data from the Average Hourly Income graph they got from the Internet, in essence making a mathematical model. This data could then be tested for accuracy and efficiency in subsequent months when new data is reported to the BLS. Students could continue to work on this model as they discover new mathematical topics that might help their model work better or be more accurate. Over time, and as they become more aware of the trends in data and graphs, other topics in the curriculum may be more appropriate to further developing the model.

Example Mathematical Modeling Activity Using Optimization

Suppose for instance that a teacher wants a geometry class to transport disposable conical shaped water cups to the county fair. One thousand cups need to be transported at a time in as small a box as possible. The decision is made to transport 6 inch diameter circles (flat). However, to maximize the amount of water the cups can hold the class needs to decide what size wedge needs to be cut out of each circle in order to maximize the volume.

Approach #1: A group of students decide to try measuring by trying different sizes of actual cups and graph their results.

Approach #2: A group of students decides to use the formula of a cone and substitute different values for the variable of height and radius, graph the results and make a formula that fits

Both groups of students have chosen the right approach to build a mathematical model. The next step for them is to actually come up with some sort of equation or formula that can be tested and refined in a way that will allow them to use what they have learned from the textbook to add to their applied knowledge base. This process would be continued to improve the model during the course of the lesson unit.

Bringing it all Together

Modeling activities for mathematics seem to be a natural extension of Problem Solving as defined by the NCTM, but using modeling activities takes patience and time on the part of the teacher. At any rate, teachers wishing to incorporate modeling activities into their existing curriculum can typically spend less time by looking for data sets on the Internet that provide natural extensions of textbook problems, and then have students simply investigate to see what they can find. It is ultimately this process of investigation that builds true mathematical understanding. Textbook topics supported by mathematical modeling activities force students into a mode where they have to spend much more time thinking about how to synthesize mathematical information than they ordinarily would when just assigned textbook problems. It also allows students to view mathematics as a subject that has multiple applications with multiple solutions. The direction of applications of mathematical procedures can then be determined by the students rather than dictated by the problems

themselves. Ultimately, it is important for both teachers and students to be aware of the fact that difficult mathematical problems are much more a perception of the mathematician than anything innate to the problem itself. The only way students will become better at the mathematical processes related to *Problem Solving* and *Mathematical Modeling* is by having the opportunity to engage in real life situations. The Internet can provide these applications without a great deal of research or effort on the part of the teacher. Remember, learning mathematics is doing mathematics, so perhaps it is time to expand to new horizons in mathematical modeling.

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Mathematics Curriculum/Technology Alignment for Pre-service Teacher Training

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Abstract: The outcomes of the technology for teaching and learning cannot be automatic, they are the result of a collaboration between the teacher, student, and the designer of the technology (Poole, 1997). The question is that how can we go beyond the presentations with kind of fancy format to obtain a collaborative result of teaching and learning. Funded by the University System of Georgia Teaching and Learning Grant, presenters developed a curriculum/technology alignment model to enhance pre-service teacher s' mathematics methods class at Kennesaw State University, Georgia. The model has brought cooperating teachers, pre-service teachers and university supervisors together to work collaboratively for the effectiveness of teaching and learning. The technology in pre-service teachers' training is no longer simply the use of computers and projectors in the classrooms. It has aligned with the mathematics curriculum in a collaborative effort dedicated by pre-service teachers, in-service teachers and university supervisor. This paper demonstrates a curriculum/technology alignment model for enhancing the instruction of mathematics in early childhood and elementary education. It discusses the means of using the model for pre-service teachers training, and explores the future of integration of technology in teachers education programs.

One of pre-service teachers entered the classroom and saw an info projector and a computer set for the class. She was very excited, "Wow! Technology! I love it!" The professor was pleased. It was not only because of the accomplishment of his using technology in the class, but also because of the pre-service teacher's enthusiasm of seeing technology being used in the classroom. It is great, no doubt about it. However, the outcomes of the technology for teaching and learning cannot be automatic, they are the result of a collaboration between the teacher, student, and the designer of the technology (Poole, 1997). The question is that how can we go beyond the presentations with kinds of fancy format, such as the effect of slide transitions, animated images, and colorful displays on the screen. How can we obtain a collaborative result of teaching and learning? More specifically, how can we have our pre-service teachers become experienced tech-users and learning facilitators of using technology for teaching mathematics effectively in P-5 classrooms? In this paper, presenters introduce a curriculum/technology alignment model for the enhancement of teaching mathematics in early childhood and elementary education. Meanwhile, the presenters discuss the means of using the model for pre-service teachers training, and explore the future of integration of technology in teachers education programs.

Curriculum/technology alignment model

Funded by the University System of Georgia Teaching and Learning Grant, presenters developed a curriculum/technology alignment model to enhance pre-service teachers mathematics methods class at Kennesaw State University, Georgia. The model is created through a CGI (Common Gateway Interface) application and a Web database. It mainly consists of curricular contents, technology components, instructional activities and assessment plan. Curricular contents include major topics of mathematics taught in early childhood and elementary education. They are numeration and number sense, place value, addition, subtraction, multiplication and division with whole numbers, concept and computation of fraction, decimal, ratio, percentage, measurement, probability, statistics, geometry, and problem solving. Each of the topics is specified with grade levels (K-5). Technology components are categorized into World Wide Web resource, mathematics software, audio and video material, and multimedia application. Besides, presenters also add mathematics manipulative and other instruments, projected or printed, to the technology components for a broaden coverage. Instructional activities bridge the curricular contents and technology components. Within this section, pre-service teachers are required to plan a specific mathematics lesson by selecting one or multiple technology components. The lesson plan includes specific and measurable instructional objectives and outlined procedures. Assessment plan provides assessment tools examine the effectiveness of the integration of technology in instruction.

The alignment model is functioning under an Internet browser. Its CGI application connects a Web browser to a Web database. The CGI allows teachers to design the curriculum/technology alignment on the Web and store the alignment in the Web database. Afterwards, teachers can easily have the information in the database edited and searched on the Web, and share the alignment with other colleagues through Internet. The CGI application is developed under Visual Basic environment. It consists of input, edit and search sub-functions. Web database is created with Microsoft Access. It provides the convenience of storing, searching and editing data.

Pre-service teachers' training

Mathematics instructional programs should use technology to help all students understand mathematics and should prepare them to use mathematics in an increasingly technological world (NCTM, 1998). To meet this standard, pre-service teachers' training is challenged and pre-service teachers' mathematics methods class needs to be innovated with the effective implementation of technology. The project, mathematics curriculum/technology alignment, is designed to face the challenge and to pursue the effective training of pre-service teacher with the implementation of technology in mathematics education. The curriculum/technology alignment model is adopted for the pre-service teachers' training in mathematics methods class at Kennesaw State University. The training consists of five phases: reviewing, exploring, identifying, developing, and teaching.

The training starts with reviewing. Pre-service teachers are guided to review NCTM standards, Georgia's Quality Core Curriculum (QCC) standards and local mathematics curriculum. The review provides them with a global view of mathematics teaching and learning, consequences of mathematics taught from kindergarten to the grade five, and mathematics textbook adopted in the schools. With the global view, pre-service teachers are required to review the textbook and students in the classroom at an assigned grade level in particular. Working with cooperating teachers and university supervisor, pre-service teachers select a content area from the mathematics curriculum at the assigned grade level, and investigate students in the assigned classroom. To report the learning, they complete a review journal to indicate their knowledge of the mathematics curriculum at the assigned grade level and the students in the classroom.

The second phase of training is to explore technology components. Pre-service teachers explore available technology in the school media center, computer lab, and library. They search technology resources from the Internet, examine mathematics software, and pre-view audio or video and other projected and printed materials. Guided by cooperating teachers and supervised by university supervisor they select kind of technology to enhance their teaching.

The third step is to identify specific instructional objectives. The objective is a specific guideline for a lesson. With the training, pre-service teachers need to be able to state an instructional objective clearly based on their reviewing mathematics standards and curriculum, and exploring available technology resources. Discussed with cooperating teachers and university supervisor, certain questions, like what is the instructional goal, what is

the learning condition, and what are the expected learning performance and performance criteria, should be precisely answered by the pre-service teachers.

The fourth phase of training is to develop curriculum/technology alignment with step-to-step instructional activities. Coherence is important. Pre-service teachers may have many ideas; however, those ideas should be coherent and focused. Assisted by cooperating teachers and university supervisor, pre-service teachers learn to outline closely related and well developed instructional activities, get familiar with curriculum/technology alignment model, and develop instruction plan with the integration of technology on the Web. Finally, pre-service teachers submit their teaching plans including instructional objective and assessment plan to the Web database for sharing.

The last phase of training is to teach mathematics in P-5 classrooms with the integration of the curriculum/technology alignment model. Early childhood and elementary education majors take mathematics methods class in their senior year at Kennesaw State University. This training occurs in the semester before student teaching practice. The training includes 10-week preparation and five-week teaching practice under the supervision of cooperating teacher and university supervisor. With the curriculum/technology model, pre-service teachers search the information in the Web database, and teach the lesson in the classroom. After the teaching, they meet with university supervisor to discuss the effectiveness and weakness of the teaching.

This curriculum/technology alignment project has provided pre-service teachers with opportunities to design lesson plans with appropriate technologies, search reliable curriculum/technology aligned resources, and teach mathematics with the integration of technology in P-5 classrooms. The project has brought cooperating teachers, pre-service teachers and university supervisors together to work collaboratively for the effectiveness of teaching and learning. The technology in pre-service teachers' training is therefore no longer simply the use of computers and projectors in the classrooms. It has gone beyond the technology use in the classroom for the technology itself. The technology components have been aligned with the mathematics curriculum in a collaborative effort dedicated by pre-service teachers, in-service teachers and university supervisor.

Integration of technology in instruction

The results of the collaboration are very positive. However, based on the implementation of the alignment model, the presenters believe that the means of integration of technology in education needs to be further explored. The integration is not automatic, is not just having hardware or software piled in the classroom, neither is having one or two technology classes or workshops for pre-service teachers. The integration requires basic technical skills, needs to have a connection with effective instructional designs, and includes clear instructional objectives, coherent activities, and measurable assessment plan.

Basic technical skills are the foundations of the integration of technology in instruction when the hardware and software become available. However, how can pre-service teachers obtain the training with those basic skills? It is still a controversial question. To sum up, there are two program structures. One is to have one or two required technology classes included in the pre-service teachers' training program. The other is to eliminate the technology classes in the program. It assumes that pre-service teachers have well been prepared in the technology before they come to the university. Having technology classes in the program helps pre-service teachers develop their basic technical skills, such as, the skills of operating systems, word processing, spreadsheet, database, Internet search, HyperStudio application when they are admitted to the teacher education program. Eliminating the technology classes in the program has its eligible reasons. The eligible reasons are that the program has a limitation of credit hours for pre-service teachers to graduate within certain school years, and that pre-service teachers are well prepared in technology.

The presenters are favor of neither of them. To include technology classes in education program is no doubt helpful for developing pre-service teachers' basic skills of technology. However, technology is a teaching and learning tool, and it can only work when the pre-service teachers understand the true value of technology (Maddux, Johnson, and Willis, 1997). One or two required classes of technology, with the focus on basic skills, do not mean an automatic successful integration. Pre-service teachers need actual curriculum integration experience in the technology courses. On the other hand, pre-service teachers are not well prepared with technology skills when they are admitted into the education program. According to the research, the majority of today's high school graduates do not know much about educational technology, nor have they had much practice and training in technology when they enter universities and colleges. With the limitation of computer facilities and time spent on

the computers in high schools, they will definitely feel frustrated with the challenge of integrating technology in instruction when they are receiving teacher education (Ouyang, 1998).

The true value of technology in the integration is the alignment of curriculum. The competency of basic technology skills is necessary and should be required for pre-service teachers. The requirement cannot be limited in one or two technology class although they are helpful, particularly for those technological illiterate and non-traditional students. Therefore, the technology classes can be optional in the teacher education program, but the competency of technological skills must be required for individuals before they get into junior and senior years in the program. Unless pre-service teachers have mastered the basic technology skills, they can integrate them in the unit and lesson planning, and practice them in the real classrooms. For the 21st century, it is important for us to put more emphasis on a curriculum guided technology training for pre-service teachers instead of limiting, reducing the training hours, and eliminating technology training class from teacher education programs. Meanwhile, flexible modules of training should be explored to meet each individual's needs. The integration should emphasize the alignment of curriculum and technology.

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Geometric Skills: From Hands-On Manipulatives to the LOGO Turtle's Path

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Abstract: There is much evidence to support the fact that manipulatives create a visual representation as well as provide a tactile (hands-on) approach to many geometric situations. De Los Santos and Patton believe that while computers create a visual representation, the tactile (hands-on) approach is missing. They conjecture that, in order for children to be the most successful, tactile (hands-on) activities using manipulatives must be included in the lessons and precede any LOGO activities. The study in progress follows a post-test only experimental design. The control group receives LOGO instruction while the experimental group receives instruction using manipulatives prior to the LOGO instruction. The post-test will measure the ability to construct interior and exterior angles and given polygons.

An old proverb is appropriate even today when using technology for teaching problem-solving: Tell me, I'll forget. Show me, I may remember. Involve me, I'll remember.

The National Council of Teachers of Mathematics Evaluation Standards (89) call for increased attention to be devoted to the use of calculators, computers, and manipulatives in assessment. Early in the twentieth century, Bruekner (30) and Brownell documented the advantages that children exhibit when introduced to manipulatives as an early method of teaching. Both Bruckner and Brownell are forerunners in the diagnostic and remedial mathematics research. Later researchers, Dienes (73), Ross and Kurtz (93), Canny (84), Walsh (94), and Ashlock (90), found definite advantages when manipulatives are included in lessons.

According to the Third International Mathematics and Science Study, fourth grade students in the United States (US) are above the international average in the area of geometry, yet well below the average by the eighth grade. In a comparison with 41 countries, the US did not score well in geometry. The national average in geometry for eighth graders in the US was 48% correct. Japanese students led all nations with 80% correct in geometry, followed by the students from Singapore with 76% correct. The international average was 56% correct. United States ranked thirty-fifth in geometry out of the forty-one participating countries (US Dept. of Ed., 96).

Research on Manipulatives

Research has shown children must have hands-on experiences to learn mathematics concepts. According to Moser (86, 9), "experiences with materials help provide a strong basis for conceptual understanding, whether it be of later procedural skills or an appreciation of properties and relationships." Moser states, "the proper use of manipulatives at the early stages of development may remove the need for later remediation." He further discusses that materials should be part of geometry, measurement, statistics, and problem solving as well as for arithmetic lessons.

Parham (83) found students who used manipulative materials scored at approximately the eighty-fifth percentile. Students who did not use manipulative materials scored at the fiftieth percentile. Suydam and Higgins (77) found lessons using manipulative materials have a higher probability of producing greater mathematics achievement than do lessons in which manipulatives are not used. The use of manipulatives appears to be of definite importance in how well children understand and achieve in mathematics (Suydam,86). Canny (84) found

significantly higher differences in problem-solving scores of fourth-grade students when manipulatives were used to introduce content.

Children are helped in the building of firm understanding of mathematical concepts by the use of manipulative materials (Kennedy, 86). "The meaning theory," espoused by William Brownell early in the twentieth century, "is based on the belief that children must understand the basic concepts that underlie what they are learning if learning is to be permanent" (Kennedy, 86, 6). According to Dienes (73, 11),

> The most primitive notions in geometry are not to do with measurement. A child is not particularly concerned as to the exact distance to certain objects, or just exactly how far he has moved, or at what angles certain objects are situated. He takes notice of these in an implicit sort of way. What is interesting to him is getting things for himself--moving about in space, in order to do what he wants.

Piaget and Richard Skemp concluded in their studies of cognitive development that individuals pass through four stages as they mature and manipulative materials are learning aids which are significant in all four stages (Kennedy, 86). Fennema and Dienes advocated the use of manipulative materials for children in early learning. As children mature and are able to handle concepts symbolically, these researchers supported the gradual decrease of manipulatives (Kennedy, 86). Geometry and other topics in mathematics that middle graders deal with are better understood when children use manipulatives in appropriate ways (Suydam,86). Ignoring and abandoning manipulatives too quickly can put children at risk when developing new mathematical concepts, according to Driscoll (81).

Many LOGO studies involving children at Piaget's pre-operational stage may have had invalid results as young children were instructed in manners which may not have been developmentally appropriate. Dienes (73) states that young children may not have developed concepts of distance and measurement; therefore, children may not be successful in angle measurement and length, which are basic concepts associated with LOGO. Angle measure and length concepts are abstract concepts which may not be developmentally appropriate activities for young children.

Research on LOGO

LOGO, which means "word" in Greek, was developed in the late 1960's by Seymour Papert and his colleagues at Massachusetts Institute of Technology's (MIT) Artificial Intelligence Laboratory. LOGO was designed to provide an environment in which students learn in a natural setting (Papert, 80). LOGO was developed to serve as a conceptual framework for the learning of mathematics. One rationale for LOGO programming is that students will learn geometry by utilizing concepts that aid them in understanding and directing the LOGO turtle's movement (Clements & Seriema, 95). Papert believed LOGO would enable students to learn mathematics as naturally as they learn to speak.

Computer environments are designed to allow students to build on their visual strengths rather than tactile skills. The connection needs to be made between LOGO code (program) and the resultant figure (output). Computer environments provide students with ease of editing, repeating constructions, and operations; thus, promoting construction of geometric notions and increasing analytical thinking. The ability to create, alter, and reflect on procedures, is powerful because it allows students to treat sequences of actions as cognitive objects that can be altered and reflected upon. Computer environments should create a problem-solving atmosphere conducive for exploration and conjecture (Clements & Battista, 94).

Constructive computer environments appear to facilitate the students' progression to higher levels of geometric thinking. In the LOGO environment, students are able to make connections between specific examples of geometric shapes and abstract characteristics of shapes. The LOGO environment facilitates and illustrates precision and exactness in geometric thinking. LOGO's turtle graphics environment encourages students to build upon their geometric knowledge. Clements and Battista (94) firmly believe this provides a reason to begin geometric explorations using LOGO and that the LOGO environment mirrors students' geometric thinking.

Evaluation of learning environments must be reconsidered. Traditional approaches do not assess students' conceptual or higher order thinking. Pre- and in-service teachers need their skills upgraded periodically in order to provide their students with constructive pedagogical environments that incorporate geometric computer technology. Researchers must discover how computer environments can be utilized to build on the geometric knowledge students acquire each year (Clements & Battista, 94).

Clements, Battista, Seriema, Swaminathan, and McMillen (97) investigated the development of linear-measure concepts within an instructional unit on geometric paths, including the role of noncomputer and computer interactions. The conjecture was that combined noncomputer and LOGO experiences positively affect length measurement skills. At the first level of acquiring strategies for solving length problems, students have sufficient physical measurement experience iterating and partitioning into units. This experience allows the students to construct schemes that allow them to partition unsegmented lengths. Second-level schemes are figurative in that the students need to use physical action to create perceptual partitions. As these partitioning schemes develop, they include the constraint that equal intervals must be maintained in solving problems. The equal-interval constraint can be realized most efficiently when it is done in imagery, in anticipation, without forcing perceptual markings. This equal interval constraint leads to the construction of an anticipatory scheme as the third-level strategies begin to emerge. Students who do not connect spatial and numerical schemes will benefit from activities that guide them to synthesize the two schemes. LOGO may help students progress along these three levels of measurement skills.

Yusuf (91) studied the effects of LOGO Based Instruction (LBI) on students' understanding of the concepts of point, ray, line, and line segment. Sixty-seven students in grades 7-8 participated in this study. The experimental group received LBI and the control group received traditional lecture, and paper and pencil instruction developed by Yusuf. Students taught by the LBI method scored significantly higher when tested on conceptual knowledge of point, ray, line, and line segment.

Van Hiele's (86) research revealed LOGO experiences can help students learn geometry; however, it also revealed students often continue to use visually based, nonanalytical approaches. The research of Clements & Battista (94) and Yusuf (91) appear to be in agreement with Van Hiele.

One reason frequently cited by researchers (Burns and Hageman, 89; Swan and Black, 88) and decision-makers in education for placing such a heavy emphasis on computer programming is its presumed impact on problem solving beyond programming activities. Masterson (85) found LOGO is one of few programming languages designed to meet requirements of being simple yet powerful and cognitively efficient. LOGO programming activities are believed to contribute to problem solving. Burns and Hagerman (89) found that third grade children who received LOGO instruction emphasized decomposition of complex problems in problem-solving. They concluded that certain qualities of LOGO can increase mastery-oriented thinking in young children.

Swan and Black (88) tested 133 students in grades 4-8 who had 30 hours of LOGO instruction. Five of six problem-solving strategies which were found to transfer from a LOGO environment to a general problem-solving environment were: strategies formation, forward chaining, systematic trial and error, alternative problem representation, and analogical reasoning. Backward chaining was not found to transfer. Swan (89) found transfer of subgoal formation, forward chaining, systematic trial and error and analogy; but, did not find alternative representation to transfer from a LOGO environment to a general problem-solving environment among students in grades 4-6. Swan and Black (88) also found highly significant differences between grade levels on measures of subgoals formation, systematic trial and error, and analogy. They concluded that developmental differences in students affect a student's ability to transfer certain problem-solving strategies. These findings support Piaget's conclusions that systematic trial and error strategies are an important determinant of formal operational ability.

Clements (86) studied the effects of LOGO and CAI environments on cognition and creativity on students in first and third grade. The third grade students scored significantly higher regardless of treatment. These results may be due to the cognitive differences between the two age groups. Both treatment groups had significant increases on classification skills. The LOGO treatment was most effective on classification, seriation, and creativity. There were no significant differences among the treatments on reflectivity and impulsivity or reading and mathematics achievement.

Pea and Kurland (84) tested thirty-two children aged 8-9 and 11-12 and found no transfer of planning skills from a LOGO environment to a nonprogramming environment. Older students had better planning skills than the younger students, however, think time for programming and nonprogramming students did not differ. There was no evidence that the programmers were more likely to follow a model of planned debugging than nonprogrammers. Cognitive development may be a significant underlying factor.

Lehrer, Guckenberg, and Lee (88) evaluated the influences of LOGO on 45 third grade children. One group was taught how to apply general programming strategies to solve problems presented in LOGO, a second group was taught to use LOGO to solve geometry problems, and the third group was a nonprogramming group. The two LOGO groups were better able to plan a solution and had significantly better understanding of informal geometry concepts than the nonprogramming group.

Geva and Cohen (87) outline four prerequisite skills for learning LOGO: distinction between right and left, use of the turtle as a frame of reference, assignment of appropriate axis, and application of units of measurement for determining distance and angles. Some first and second grade children do not know left from right. Most primary

children have difficulty determining the turtle's left or right when the turtle is facing down, to the side or at a diagonal. Students with egocentric conceptions of space have trouble differentiating between their right and the turtle's right. Mayer and Fay (87) noted that students, who lost their egocentric misconceptions or who never had them, showed significant gains on spatial cognition while the egocentric children did not. Students, who have no concept of what length or angle measure are, have difficulty understanding the concepts underlying programming in LOGO. Some children have difficulty in realizing that "Right" and "Left" commands only turn the turtle and do not move the turtle as the "Forward" and "Back" commands do (Geva and Cohen, 87; Fay and Mayer, 87). Some students have misconceptions about the numeral entered with the "Left" and "Right" commands. They may believe the numeral represents the length of the side rather than an angle measure. This implies that it is difficult for most young children to master LOGO without extensive instruction.

Simmons and Cope (90) tested 59 children between the ages of 9 and 12 after three months of LOGO instruction. While 92% of the children were able to write the code to draw a square, only 24% wrote the correct code for a triangle. None of the children were able to mark the rotation angle or exterior angle. Most children marked the interior angle formed by the turtle's rotation. Results showed that 97% of the children were able to estimate the size of a 90-degree angle while 36% of the children confused the exterior and interior angle estimates. The results indicate confusion about constructing internal and external angles with LOGO commands.

Cope, Smith, and Simmons (92) found both elementary and secondary students had misconceptions about turtle rotation and the resulting angle. Students were confused about interior and exterior angles when constructing regular polygons. They were not aware that the turtle rotates according to the exterior angle when constructing a regular polygon, i.e., the turn command "Right 120" constructs the exterior angle of a triangle rather than the interior angle of 60 degrees. There were twelve students aged 10-11 who participated in a 12-hour LOGO course. The concept of exterior angles was emphasized. Results indicated that students could estimate angles out of the context of the LOGO environment but did not make the connection between turtle rotation in LOGO and exterior angles. Results seem to indicate knowledge of complimentary and supplementary angles may need to be taught before children learn LOGO.

Kieran (86) found that fourth and sixth grade students were not able to understand the relationship between the angle of rotation (exterior angle) and the constructed angle (interior angle). Fourth grade students were confused by the fact that "Right 45" created a larger interior angle than "Right 90" in the following sequence of commands: "Forward 100, Right 45, Forward 100" and "Forward 100, Right 90, Forward 100". The first set of commands creates a 135-degree angle and the second set of commands create a 90-degree angle. Kieran used a Laser Turtle which illuminated the screen with a laser every 5 degrees as the turtle rotated. Kieran found that many of the children were still confused about the relationship between the constructed angle and angle of rotation. The students were also confused about the relationship between the measure of the angle and the lengths of the "arms". The students could better draw a figure which corresponded to given commands (show the output) than provide the commands which were needed to draw a figure (write a program).

Children develop more mathematically correct, coherent, and abstract ideas about angle and turn concepts after working with LOGO (Clements, et.al., 96). However, Kynigos (1993) believes that further investigation needs to take place on the design of geometrical computer programs and their use in learning situations. Research will possibly provide opportunity for more focus on the instruction of geometric ideas using developmentally appropriate practices.

Activities with Manipulatives

De Los Santos and Patton have designed activities to help students understand geometric concepts which may be essential before programming using LOGO. Each of the hands-on activities involve the use of manipulatives. These activities are: 1) introduce concept of angle, 2) introduce 90°, 180° and angles of other degrees, 3) measure complementary angles, 4) measure supplementary angles, 5) introduce interior angles, 6) introduce polygons, 7) measure interior angles of polygons, 8) introduce exterior angles, and 9) measure degrees in a circle.

After the students have been introduced to these concepts using manipulatives then LOGO activities may be presented. DeLosSantos and Patton have incorporated the following LOGO activities to help students understand concepts which are essential to the understanding of geometry. These activities will be used immediately after the hands-on activities with manipulatives . The shareware "Microsoft Windows LOGO" will be used. The activities are: 1)introduce the LOGO software, 2) introduce the turtle, 3) move the turtle (Relationship to length of line

segment), 4) turn the turtle (Relationship to angle measure), 5) create figures, 6) define procedures, 7) write procedures with variables, 8) develop polygon procedures, and 9) create own designs.

Conclusions

According to Brownell, instruction must be meaningful and must be organized around mathematical ideas and relations. Students "must also have experiences in using the arithmetic they learn in ways that are significant to them at the time of learning, and this requirement makes it necessary to build arithmetic into the structure of living itself" (86, 38). He believed computational skills among schoolchildren would be greater if the children were taught with an emphasis on concepts rather than memorization of facts and algorithms. Brownell (87, 39) believed the most common error in teaching mathematics was "the acceptance of memorized responses in place of insistence on understanding".

Battista & Clements found that elementary students use visual imagery to reason. They suggest teachers allow students to use this mode of reasoning to learn geometric ideas. Teachers need to ask questions that help students incorporate conceptual knowledge into their visual-reasoning processes. Visual imagery can make a substantial contribution at all levels of geometric thinking. In teaching geometry, teachers should not only focus on properties of figures and relationships among them, teachers should "help students develop vivid images and coordinate these images with their conceptual knowledge" (Battista & Clements, 91, 20).

Edwards concluded that the LOGO environment is an example of a computer software package which supports mathematics learning. This type of mathematics "learning is constructivist since the learner must build upon his or her existing knowledge". The LOGO environment has the "potential to allow students more independent and self-directed exploration of mathematical patterns". Edward believes the learner is able to go beyond the goals of the software and "continue to satisfy their own desire to find meaning and order in their educational experiences" (92, 79-81).

Difficulties and misconceptions in geometry can be easily masked by traditional approaches but must be dealt with in a LOGO environment. This may lead to some frustration for both the teacher and the students but also to greater development of mathematics abilities. The meaningfulness of the visual representations provides an opportunity to enhance students' intuitions. Students can analyze geometric situations, discover concepts, and construct sophisticated ideas when they are given the proper tools, time, and teaching (Clements & Battista, 94).

Geva and Cohen (87), Fay and Mayer (87), Mayer and Fay (87), Simmons and Cope (90), Cope, Smith and Simmons (92), and Kieran (86) addressed the difficulties and misconceptions in geometry that plague students in their respective studies. The students were confused and made errors in the following areas: length, angle measure, and interior and exterior angles. The relationship between concepts proved to be very difficult for the students. These researchers concluded that when the students were presented the concepts only in a LOGO environment that misconceptions occurred and the students did not have transfer of learning to other environments.

Simmons and Cope (90) concluded that teachers should not assume that unstructured use of LOGO with minimal teacher intervention will benefit children's concept of angle and angle measure. According to Piaget and Inhelder (67), children's representations of space are based on action, rather than on passive copying of sensory data. "Children's actions in certain LOGO environments are both perceptual--watching the turtle's movements, and physical--interpreting the turtle's movement as physical motions like one's own" (Clements & Seriema, 95, 382).

De Los Santos and Patton believe that a LOGO environment creates a visual representation; however, the tactile (hands-on) approach is missing. They conjecture in order for children to learn concepts of angle and angle measure a combination of LOGO activities and tactile (hands-on) activities with manipulatives must be included in the lessons.

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Bustin' The Barriers--Power On!

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Abstract: Getting at-risk students to not only succeed, but also to excel, in the algebra classroom is a daunting task. In this project, high school teachers form four different high schools and their students combine efforts with tow university instructors to use new forms of technology to "bust out" of the pattern of failure and disconnected learning. Teachers and students develop web-based testing and teaching materials, learn how to work effectively as a team in an electronic meeting space, and master some critical mathematics skills in the process.

Theoretical Framework

Algebra is considered a "new civil right" (Moses, 1993). This implies that all students should have access to the benefits associated with mathematical understanding, which leads to quantitative literacy. The gatekeeper for quantitative literacy is algebra (Dossey, 1998). Far too often, Algebra I acts as a deterrent to higher mathematics (National Action Council of Minorities in Engineering, 1995).

Mathematics, specifically algebraic skills, and at-risk students usually do not mix well in the mathematics classroom. Recent reports, both national and international, reveal that a mathematics achievement gap still exists between minority and non-minority student populations, with the exception of Asian students. Scores on the 1992 National Assessment of Educational progress revealed that Hispanic and Black students performed at a much lower level than White or Asian students in mathematics, especially at the more complex and extended-constructed response tasks. In regard to technology, Hispanic students have less access than their white counterparts to technological tools, such as graphing calculators and computers (Silver, Strutchens, & Zawojewski, 1997). The purpose of this paper is to report on a project that involves public high school mathematics teachers and university researchers working together to enhance understanding of high school algebra.

Language and Problem Posing in Algebra Classrooms

One model for learning algebraic concepts involves language. Some difficulties arise when students are unable to think of mathematical objects as concrete models and then use linguistic ability to explain the model (Dossey, 1998). The constructivst learning technique of problem posing is beneficial for developing mathematical understanding. The constructivist technique offers students an opportunity to link concrete algebraic models with their linguistic models (Brown & Walter, 1993).

The act of problem posing allows students and teachers to use the emerging relevancy for increasing the level of understanding (Brooks & Brooks, 1993). In order for algebraic understanding to occur, students should use the language repeatedly over an extended time period. Students should use the language of mathematics for expressing something meaningful and relevant. For example, students can express quantitative relationships of their understanding of relationships outside of mathematics when language is used to model our world (Kaput, 1998). Helping students to use language for expressing mathematical ideas requires guidance from teachers who have developed a repertoire for mathematical constructions consisting of posing, constructing, exploring, solving and justifying mathematical problems and concepts in order to develop a similar capacity to reflect on, and pose, mathematics problems (Confrey, 1990).

The Role of Technology

It has been suggested that technology's role in algebra instruction should be expanded. This expanded role may include the use of numerical or symbolic computations and actions taken on graphical objects (Kaput, 1993). On the one hand, the World Wide Web is an emerging environment in which to exercise algebraic reasoning (Akst, 1998). Teachers now have the option to use the web for sources of information for problem posing. On the other hand, the World Wide Web can be used as a means of communication and as a site for student projects. However, using the Web as a means for students to communicate and pose their means for solving problems is considered to be less helpful in mathematics education with the exception of the Virtual School where students can find math problems to solve (Schwartz & Beichner, 1999).

With recent developments in communications technology, students are now able to participate in an environment where reasoning is necessitated in order to effectively communicate with remote, peer learners (Zbiek, 1998). But if students are to have the opportunity to construct their meaning and make sense of their world, then teachers must begin to relinquish some of their management and intellectual authority (Jonassen, Peck, & Wilson, 1999). Consequently, teachers must accept a new model of learning if students are to learn with technology.

Jonassen, Peck, and Wilson, (1999) have identified five aspects to personally constructed knowledge, when technology is employed as the tool for assisting in meaning construction. Meaning construction requires active learning where students explore and manipulate components of technology-based environment and observe the results of their activities. A second aspect is constructive learning, which involves students in articulating what they know and reflecting on their understanding in a

larger societal role. Allowing students to set their own goals and regulate and manage their activities is the third aspect called intentional learning. Authentic learning, the fourth component, occurs when students examine and attempt to solve complex ill-structured, and real-world problems. This occurs in a cooperative learning setting where students socially negotiate the meanings that they have constructed.

Problem Solving and Problem Posing

Each of the five aspects of the new environment establishes a positive atmosphere for problem solving. Problem solving, as well as problem posing, is an important ability for students to possess as an outcome of instruction. The manner in which students act or react to mathematical situations is reflective of their attitudes or beliefs about themselves and mathematics as a discipline (Shoenfeld, 1985). For example, the attribute of persistence concerning mathematical problem solving is related to the belief that mathematics problems should be solved in less than three minutes. If a student holds this belief, then the student that encounters a task that takes substantially longer than three minutes to complete may be leave the problem unsolved. A classroom's social context has an influence on particular attitudes during problem solving. For example, enthusiasm for problem solving is dependent upon a supportive classroom environment with social norms that supports enthusiasm and enjoyment of problem solving (Grouws & Cramer, 1989).

The Project, Busting The Barriers

Project Frameworks

The current project , Busting The Barriers, is emerging within the following conceptual, technological, and institutional framework.

Conceptual Framework

Conceptually, the project is based upon the belief that students, particularly at-risk students, need to "bust out" of the current cycle of poor or inappropriate mathematical understanding, poor communications, and meaningless problems. In order to do so, these students need:

to see relevancy in their mathematics endeavors,
to know how to communicate using mathematics,
to have continuous opportunities to experience meaningful problems and opportunities to communicate their interpretations of their mathematical beliefs,
and to experience some sort of tangible accomplishment other than the traditional form of a grade when they are interacting in a mathematical environment.

Technological Framework

The following technological assumptions and capabilities are as follows:
all participants have access to the Internet in the classroom,
teachers and students can function as designers and developers but do not need the expertise to develop web-based materials, but must have access to someone with that expertise,

This latter assumption provides for all participants who want to design materials the knowledge that they need not get hung up on the barrier so many school faculty feel about the inadequacy of their technological expertise. Students are less susceptible to the paralysis imposed by that feeling of "I can't do that, so why bother to try." However, students do need to know that, if they take their design endeavors seriously and creatively, those plans will assume tangible form.

Institutional Framework

The institutional framework for this project is the undeniable political pressure imposed upon schools, particularly those with large numbers of at-risk students, to get those students to increase their performance on some sort of annually administered assessment device. In Texas, this device takes form as the Texas Assessment of Academic Skills (TAAS) and the end-of-course (EOC). Building principals, classroom teachers, parents and students know these realities drive the day-to-day functioning of curriculum and instruction. Any attempt at revisions in ether curriculum or instruction are, a priori, doomed to failure if those revision attempts do not effectively address state mandated assessment issues. Any attempts to integrate technology into instructional delivery without clearly demonstrating how that use of technology will improve student performance on these state assessment devices is a waste of both time and money.

Project Description

The Busting The Barriers project is a collaborative project among two university professors and high school mathematics teachers. The project is designed to actively involve students in the development algebra problems, as well as develop critical skills for passing a state mandated, end-of-course (EOC) examination. The student-developed problems are meant to reflect real-life experiences. Students subsequently put their problems on the web, allowing their counterparts from across the Rio Grande Valley region to submit solutions for peer review.

Teachers' problems (based upon the EOC) provide a web delivered bank of problems for use as practice problems in preparation for a very high stakes tests -- the aforementioned EOC which, thus far, has defied a variety of efforts by concerned staff to boost student passing rate. Online testing and review looks very promising at this point, when coupled with students' designing, developing and posting to the web their own problems and accompanying solutions (highly graphics oriented -- visual props seem to work well with at-risk students).

The process connects a triad involving high school students from area high schools, those students' mathematics teachers, and two university professors. The students in the project attend high schools located along the Lower Rio Grande River Valley of Texas. The student population is 98% Mexican

American. Some of the students attend small, rural schools. Other students live in a large, urban school district.

The high school mathematics teachers' roles are to supervise the development of the student problems and solutions, to develop a database of EOC sample problems, and to implement the classroom use of the materials as those teachers deem appropriate. The lead public school mathematics teacher has also been a technology lead teacher.

The university professors provide a clearinghouse for group-developed materials and serve as project coordinators. One professor is in educational technology with a strong mathematics background and the second professor is in mathematics education.

The project is highly ambitious, involves various groups serving in different capacities, all viewing technology as not an end in itself, but a realistic means, or tool, for developing enriched, purposeful learning environments. Currently, both materials and assessment are on-going. However, initial reviews of materials by students, and students' subsequent performance on pilot examinations, are encouraging. Particularly noteworthy are comments students are making about this process as a whole. Paraphrasing the students, they feel more connected to their learning and can see the relevance of different types of materials and instructional approaches. This feeling of enhanced connectivity seems due, in part, by classroom discussions that evolve from students' developing and using the online materials.

The project is still in its infancy. Further, longitudinal study is needed on students' subsequent performance on state mandated examinations. Further means for developing communications among the various participants need to be explored. And further uses of more sophisticated types of development materials need to be placed at the disposal of all participants, along with requisite training for using those developmental tools. However, at this point, we feel we can safely say that teacher and student development of materials has long been noted as a powerful means for getting all classroom participants actively involved in their own learning process. Web-based materials and development tools are a logical progression in continuing this process.

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Learning in the Context of a Mathematics Teacher Education Course: Two Case Studies of Elementary Teachers' Conceptions of Mathematics, Mathematics Teaching and Learning, and the Teaching of Mathematics with Technology

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Abstract: This phenomenological study took place over a 16-week semester during which 12 elementary school teachers explored mathematical ideas for elementary school students while using computer microworlds. Four themes of learning on her own, authority and control, mathematics as manipulating, and frustration and confusion were manifested in the case study of one teacher. The second case study brought forth the two themes of learning with others, and authority and control. The study demonstrates how the teachers' experiences can serve as a basis of a theoretical model for informing mathematics teacher educators about the multi-dimensional aspects of teachers' learning.

The purpose of this paper is to present some of the findings of a phenomenological study which described and interpreted the experiences of two female elementary school teachers as they understood and ascribed meaning to their conceptions (i.e., knowledge, beliefs, attitudes, and emotions) of mathematics as a discipline, the teaching and learning of mathematics in their classrooms, and the teaching of mathematics with technology in the context of a technology-enriched mathematics teacher education course. Whereas there is widespread agreement that teachers are key change agents to bringing about reform in the teaching and learning of mathematics including the teaching of mathematics with technology in their classrooms (Kaput, 1992; National Council of Teachers of Mathematics, 1991; Willis & Mehlinger, 1996), there is little research about the developmental process of teachers' learning in technology-enriched environments in order to facilitate the changes advocated in reform documents. This paper provides insight into how teachers' conceptions are formed and modified in the context of a mathematics teacher education course and facilitates informed decision-making concerning the infusion of technology into mathematics teacher education.

Addressing the problem of most teachers' lack of infusion of technology into reformed mathematics curricula and reformed teaching practices is important because many teachers who have not experienced mathematical learning in technology-enriched environments find it difficult to facilitate students' mathematical learning in such environments. According to the National Governors' Association (1991), "the most effective training is accomplished within the curricular area which the technology is to be used" (p. 37). Bull (1997) concurs that the "standards established by teachers and subject matter specialists in specific content areas may prove to be the most useful" for the integration of technology in teacher education programs (p. 338). A key issue that needs to be addressed for mathematics teacher educators or staff developers is how to design a professional development program which simultaneously challenges teachers' conceptions about mathematics, the teaching and learning of mathematics, and teaching of mathematics with technology, and provides opportunities for teachers to develop their confidence and competence in mathematical thinking and pedagogy while teaching with technology in their mathematics classes.

Theoretical Framework

Drawing on a blending of perspectives, I pulled together the intertwining strands of phenomenological, social constructivist, and affective perspectives which was based on an interaction between Confrey's (1991) potential integration of Piaget's and Vygotsky's theories of cognitive, intellectual development and McLeod's (1992) theoretical constructs of affective development, and a strengthening of the construct of attitude to include emotional intelligence; this resulted in a theoretical model that extended Myers' (1980) reciprocal

model for interactions between learners' attitudes and behaviors. The phenomenon of this study is the teachers' perceptions of their learning which are based upon their interactions with the following: their own procedural and conceptual knowledge of mathematics, how to teach mathematics, how children learn mathematics, technology and teaching of mathematics with technology, the instructor and other teachers in the teacher education course, and non-human elements such as the computer microworlds.

Cobb (1994) calls for a coordination of constructivist and sociocultural perspectives in research about mathematics teaching and learning. Confrey (1992) discusses a new challenge for research concerning the role that technology plays in an individual's development of mathematical knowledge, and the viability of components taken from both Piagetian and Vygotskyian frameworks. Specifically, she raises the issue of "How ought we to view knowledge as it evolves in relation to our interactions with non-living objects and our interactions and interconnections with other human beings, and the interactions between these two types of interactions?" (Confrey, 1992, p. 44). It seems that both the types of interaction and the available tools of language and computers are crucial to a *co-shaping process* in which individual conceptions and social interactions contribute to cognitive development.

Important as the constructivist and sociocultural perspectives of teacher's learning might be, they seem to be incomplete. Using Mandler's cognitive approach to research on affect, McLeod (1992) proposes the reconceptualization of the affective domain in mathematics education to encompass not only attitudes but to include "beliefs, attitudes, and emotions as representing increasing levels of affective involvement, decreasing levels of cognitive involvement, increasing levels of intensity of response, and decreasing levels of response stability" (p. 579). Given the increased focus on high-level, conceptual understanding of mathematics recommended by current reform documents, a potential increase in the intensity of affective responses (e.g., emotions) to mathematics may result in promoting more positive or negative attitudes when compared to affective responses to mathematics while learning low-level, procedural understanding of mathematics. Within the context of the teaching of mathematics with technology, continued advancements in technological innovations may significantly change what mathematics is taught, and this may result in changing our beliefs about what is valuable in mathematics.

Participants and Data

Making the choice to participate in professional development courses for a reformed vision of the teaching and learning of mathematics that includes teaching mathematics with technology is accompanied often by a sense of anticipation. Some teachers have very little experience and expertise, and others have a great deal. Over the course of the semester, I studied the conceptions of three teachers, but for the purpose of this study I chose to focus on Robin and Susan. Robin's decision to enroll in this master's level mathematics teacher education course was motivated by her need for more "teacher training," her feelings of inadequacy towards understanding mathematics, and her desire to teach conceptually-oriented lessons involving manipulatives and mathematics software. At the time of the study, Robin was teaching a class of third graders for her second year in this school and had taught for seven years. Robin remembers experiencing the learning of mathematics as a subject that did not make sense to her as a child. Towards using technology, Robin describes that she likes working with computers (including the Internet) and learned to use them mostly on her own; she also enjoys spending many hours helping other people set up there computer systems.

Susan, the teacher in the second case study, explains that she enrolled in this course as part of her requirements for completing a master's degree in mathematics education. She describes the difficulty in finding courses that are "focused on the math and elementary together" and hopes for "a mix of ideas about theories of how kids learn and a set of practical, not lesson plans, but the idea of, what can I walk into my classroom and do." At the time of this course, Susan had taught for six years and was teaching a fourth-grade class for her second year in this school. She remembers testing out of the required mathematics courses for elementary education majors and she enjoys taking mathematics courses. When teaching with technology, she uses computers for students' drill and practice in mathematics, exploring patterns and problem solving with calculators, word processing, and e-mail connections to participants in the Alaskan Iditarod race.

The primary goal of the course centered on the teachers' exploration of mathematical knowledge within the domains of whole numbers and rational numbers through their use of *Tools for Interactive Mathematical Activity* [TIMA] (University of Georgia, 1994) computer microworlds and manipulatives. The *TIMA* microworlds developed from an analysis of the types of activities children employ in their construction of

number sequences and fraction schemes (Biddlecomb, 1994; Olive, 1993; Steffe & Olive, 1990). In the *Toys* microworld, *discrete* objects or toys can be replicated on the screen, connected, and counted as individual or composite units. Counting is a universal activity in which the learner constructs schemes relating objects to number. In the *Sticks* microworld, *continuous* objects or sticks are constructed on the screen, segmented, or iterated into composite units. Using the *Sticks* microworld, children use measuring strategies such as comparing, ordering, and quantifying in constructing knowledge about fractions. Given the research (Olive, 1993; Steffe & Olive, 1990; Tzur, 1995) on the role children-computer interactions and teacher-student interactions play in children's development of whole number and fraction knowledge, the study presented adapts these findings for examining teachers' knowledge of whole numbers and fractions.

As a participant observer, I recorded field notes for all graduate class sessions and videotaped each class, with one camera recording large group activities and the second focusing on the case study teachers. I conducted case studies of three of the teachers, including four audiotaped interviews with each teacher, collection of reflective journals and final projects, a series of nine classroom observations of the teachers in their classrooms, and pre- and post-course attitude surveys for all 12 teachers. Tapes (audio and video) were transcribed and analyzed. Data were collected and analyzed following the inductive process of *constant comparative analysis* described by Glaser and Strauss (1967). The analysis process consisted of identifying emerging themes and relating these to literature on elementary school mathematics teachers' learning, conceptions, technology, and teaching mathematics with technology, and developing assertions.

As part of a larger study, only a selected part of Robin's and Susan's conceptions of teaching mathematics with technology is presented in this paper.

The Experience

At the beginning of the study, both Robin and Susan described technology as machines or modern inventions that made peoples' lives "easier." They articulated that computer games were a fun way for students to practice basic mathematical skills. During the mathematics teacher education course, both women explored mathematical situations in which the *TIMA* microworlds were used regularly as tools to enhance their own and their students' mathematical learning. However, clear differences emerged in the teachers' experiences.

Doing mathematics with a computer is becoming involved with making sense of a partner's mathematical thinking through his or her actions and language while interacting with the computer; or, if working alone, only making sense of the learner's own thinking. Becoming familiar with mathematics while using a computer is about becoming part of both a community of mathematics learners and computer users who share values and expectations. For Robin, learning with a computer meant learning on your own and figuring things out by yourself. Characterizing herself as not being a "social learner," when Robin worked alone with the computer, she did not have to provide explanations for her actions or share her mathematical knowledge with others. In many instances, Robin's lack of conceptual knowledge of specific mathematical topics limited her ability to develop the language of mathematics and communicate her mathematical understandings of concepts to the other teachers. During our second interview, Robin struggled with her explanation about concept development and indicated she did not "know how to say these things."

Susan, on the other hand, explicitly articulated explanations about her conceptions of mathematics and specific mathematical topics, ways of learning to teach and how she taught mathematics, and how children learn mathematics. Already having some understanding of most of the mathematical concepts underlying the instructor's computer microworld tasks, Susan watched and joined in her partners' work, reflected and commented on their methods, and suggested alternative actions as they completed the tasks. Communicating mathematically was important for her own learning and that of her students; as Susan said, "So the things that were much more meaningful to me are the group work and the class, class-wide discussions." Consistent with Moreira and Noss' (1995) study, learning style influenced Susan's ability to construct an understanding of elementary mathematics topics and the teaching and learning of mathematics.

There remained a contradiction between Robin's enjoyment in figuring out knowledge related to *computer* actions by herself and her fear in figuring out knowledge related to *mathematical* actions and ideas. Unlike in Moreira and Noss' (1995) study, Robin's lack of confidence with mathematics and familiarity with computers did not develop into a "deeper confidence" with rethinking her knowledge about mathematics. When Robin talked about the mathematics of the computer tasks, she felt that the tasks were "very hard" and too "abstract" for her own understanding and that of her third graders. Such a situation can be interpreted as Robin disliking the computer tasks because she could not depend on the role visualizations played in her

understandings of mathematics (i.e., to transparently *show* her the mathematical concepts involved) to come up with an explanation on her own and talk about the mathematics. Still, significantly influenced by her interactions with the *TIMA* microworlds, Robin commented that the microworlds were a "good way" to make things a "little more abstract" than using manipulatives because the students could still see things on the computer screen but they couldn't touch them. She said, "Now they have to make a connection from something that they see in their brains and not with the touching." Because the objects of the microworlds helped Robin visualize a unit, she constructed and reflected upon her understandings of children's construction of number knowledge. For example, Robin defined the term *composite unit* by specifically using the *Toys* microworld to string and chain five shapes until 45 shapes appeared. When I asked Robin how the microworlds helped her understand children's mathematical learning, she talked of things making "sense" when she could actually see the connected units (e.g., strings and chains) and the separate, individual units (e.g., the single shapes). In using the visual representations of the microworlds, the context necessitated the development of a mathematical language in which Robin constructed a relationship between the actions and objects of the microworld, and mental schemes related to the mathematics embedded in the microworlds.

Robin's conceptions of teaching mathematics with technology remained relatively constant throughout the course. Teaching mathematics with technology meant using the overhead projector to demonstrate activities and problems with manipulatives during direct, whole-class instruction, or using computers for drill and practice and problem solving during individual instruction. Once Robin showed her students how to do the computer actions related to the software, she expected her students to work alone without any teacher intervention. In short, the computer took over as a more efficient and motivating teacher.

Working with a classroom set of calculators *fit* Susan's pedagogical approach to teaching mathematics; that is, she controlled and directed the activity of *all* students working on the same task at the same time. Susan valued and encouraged the development of a *mathematical discourse community* in which small-group and whole-group discussions focused on both Susan's and some of her students' mathematical thinking, strategies, and solutions. However, using computers in her classroom brought on feelings of questioning their value for her teaching of mathematics. In Susan's words,

> The computers though is where I feel unclear about. . . . Is there something that makes *TIMATOYS* a better tool then the fraction bar set or fraction factory. . . . I guess more the essence of my question is when is it appropriate to use that [*TIMA* microworlds] rather than just the blocks on the desks?

Shifting from a teacher-controlled, interactive teaching style of doing and talking about mathematics to a student-controlled, non-interactive teaching approach where students interacted with the computer and their partner did not make sense to Susan as an acceptable way to teach and learn mathematics. Even though Susan enjoyed the control over her own learning that she experienced while working with the other teachers and the *TIMA* microworlds, she became frustrated with having little, if any, control over or interaction with her students while they worked in pairs with the *Toys* microworlds. As Susan said, "I have no idea what they did. You know, I mean I was teaching the rest of the class. . . . So they all cycled through it, but I don't know what value it was." The introduction of microworlds on one computer into a mathematics classroom did not support an "all or nothing" interactive pedagogical approach towards learning mathematics.

Both Robin and Susan found the task of providing a meaningful conceptual explanation of *why* the invert-and-multiply algorithm works for the division of fractions to be a major conflict, or perturbation in their thinking. It is interesting, however, to contrast the two teachers' experiences. Robin openly expressed her feelings of being "terrified of math" and frustration with spending so much class time on the division task, whereas Susan enjoyed the challenge of the task and persistently went back and forth between the physical context of a scarves word problem (i.e., How many scarves can we make if it takes 2/5 of a yard to make one scarf and we have 3/4 of a yard of cloth?], the sticks model of the measurement interpretation of division within the *Sticks* microworld, and the symbolic language of mathematics to make sense of the problem situation. The processes of relating the actions and objects of the microworld to why the invert-and-multiply algorithm worked engaged Susan in challenging her thinking about the nature of fraction concepts and operations. Over the last five graduate class sessions, findings from the case study of Susan support one of Goleman's (1995) interpretations of emotional intelligence. By *motivating one's self*, Susan had the ability of focusing on an important goal (i.e., constructing a relationship between the *Sticks* microworld and why the invert-and-multiply algorithm works) during which she moved into a state of *flow* (i.e., high concentration) that facilitated her

persistence in working on the task. Susan's work on this task engaged her in participating in "mathematical learning" that she described as forcing her "to think about really tough things."

As the study progressed, Susan's conceptions of teaching mathematics with technology changed somewhat. Drawing on her experiences in the graduate course, Susan changed the focus from teaching mathematics with *technology* to teaching mathematics with *tools* in order to think and talk about mathematics. Susan's experiences of learning and talking about mathematics while using the *TIMA* microworlds, listening to the ideas of the other teachers and the course instructor, and providing explanations about how "tools" (e.g., manipulatives, microworlds, etc.) enhanced her own and her students' mathematical learning strengthened her conception that technology makes things "easier." For example, the perturbation of the invert-and-multiply task afforded Susan with the opportunity to actually see *two* sticks rather than one stick being compared on the computer screen in order to reflect, think about, and talk about a fragile understanding of how different interpretations of division relate to why the invert-and-multiply algorithm works for the division of fractions. Moreover, this enabled Susan to *fit* her newly constructed ideas about *students* rather than the teacher deciding which manipulatives as tools would be useful in solving a mathematical problem, and still keep her interactive pedagogical approach of teaching mathematics. No longer did the construct of technology remain isolated as a separate entity. Even though Susan questioned the value of technology through the use of a one-computer classroom, she accepted the value and usefulness of teaching mathematics with tools that included not only computers, but manipulatives, calculators, rulers, and other resources found in elementary school classrooms. In short, technology began to lose its status as an *add-on* component when it became transformed into the more encompassing term of tools, and conformed to an existing interpretation of technology as a tool.

By the end of the course, both Robin and Susan did not use the *TIMA* microworlds in their teaching of mathematics. When teaching with the *TIMA* microworlds, Robin explained they could be used "to remediate certain concepts," but she became "overwhelmed" with the time it took to work with students individually and discontinued using the microworlds by the end of the study. In Susan's words, "I haven't figured out how to use one, with one computer what kind of activity I can have the kids go through without me there sitting by their side to direct it." However, Susan's statement persisted as a contradiction to her conceptions of students being able to learn mathematics with microworlds because Susan believed that students "created" the mathematics, took control and tried out their ideas, and developed "their own concepts about it along the way."

Discussion of Findings: Conditions for Teachers' Learning

As part of a larger study, two assertions that can be made are: 1) Change in mathematics teaching warrants change in teacher's conceptions of mathematics and learning. Robin's experiences in the graduate course did not transform her into becoming a learner of mathematics, and she did not construct an understanding as to *why* improving her own learning of mathematics could facilitate her teaching of the mathematical concepts and skills contained within the third-grade curriculum, or her teaching of mathematics with technology; and 2) Personal learning preferences and styles influence the process of teachers' learning in technology-enriched environments. Susan's positive experiences of constructing relationships between multiple representations of mathematics and articulating the language of mathematics by providing explanation to others contributed to her ability to discuss and make explicit the mathematical ideas that she already knew related to the computer tasks, and to crave the intellectual challenge of rethinking mathematical ideas at a higher level of understanding. Consequently, mathematics teacher educators need to challenge teachers' conceptions at the *teachers'* levels of mathematical understanding and abilities to express mathematical ideas by providing opportunities of scaffolding in tasks and ensure adequate levels of internal and external support for teachers' development as learners of mathematics; mathematics teacher educators need to provide a variety of classroom organizational styles when teaching mathematics with technology to recognize the fact that differences in teachers-as-learners learning styles and differences in tasks oblige a variety of environments for learning; awareness of the role emotional intelligence plays in enhancing or blocking teachers' control over their learning; without the provision of technology-enriched innovative curriculum materials, teachers may not engage in teaching mathematics with technology through the use of computer microworlds; and, teachers can develop ways to communicate mathematically and contribute to their shared understandings through the words, objects, and actions represented in the microworlds, as well as make their conceptions of mathematics and mathematics teaching and learning explicit for themselves and others.

Collectively, these findings suggest that the experiences of elementary school teachers in the context of a technology-enriched mathematics teacher education course serve as a basis of a theoretical model for

informing teachers' learning of mathematics, mathematics teaching and learning, and the teaching of mathematics with technology. The model can serve mathematics teacher educators, educational technology educators, teachers-as-learners, and researchers by focusing their attention on the multi-dimensional aspects of conceptions (i.e., knowledge, beliefs, attitudes, and emotions) on teachers' learning by coordinating analyses of individual and group interactions from experiences with humans and non-human objects in an attempt to understand and make meaning of the social constructivist and affective components of teachers' learning.

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Dynamic Software for Discovering Mathematical Relationships

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Abstract: For the past four years I have used *The Geometer's Sketchpad* to teach geometry to a wide variety of learners. They ranged from school-age students, to education majors, to college professors. Dramatic appreciation for geometry was evident in all populations. Students discovered geometric principles for themselves that took thousands of years for humankind to realize.

While directing a National Science Foundation Project in 1994, I learned about a new piece of software called *The Geometer's Sketchpad* (Key Curriculum Press). This software was designed for the explicit purpose of teaching and learning geometry. I have since used it with a wide variety of learners in different stages of their mathematical development. These include school-age students from grades 7 to 12, college students from undergraduate to graduate school, teachers from the elementary level to the secondary level, and college mathematics professors. Without exception, I can state that *The Geometer's Sketchpad* is a big hit with everyone, even with people who have always hated mathematics. Indeed, many maintain that it is the most revolutionary software ever created for the teaching of geometry.

Usually mathematics appeals to only certain types of people. However, this unique piece of software can be extremely motivating to students because it is interactive, fun and easy to use. More importantly, it allows students to explore and discover mathematical principles while participating in cooperative groups or when working completely alone. With this tool students do not need to depend on their teacher to answer all of their questions; the *Sketchpad* responds to them immediately, in pictorial and numerical form.

Basically, the *Sketchpad* is an electronic straight edge and compass, including a set of pre-programmed constructions, and an array of measurement tools. It permits the user to examine a set of similar constructions by clicking and dragging the mouse button on the original construction. On the surface, this does not sound tremendously revolutionary. However, with paper and pencil constructions, only one construction may be examined at a time. Whereas, with the *Sketchpad*, salient features of a construction can be reproduced repeatedly by clicking and dragging the mouse. In this way, a vast array of cases may be viewed at once. This feature allows students to discover mathematical relationships that human beings were unable to discover for thousands of years. In fact, in 1995 two high school students, Dan Litchfield and Dave Goldenheim, used the *Sketchpad* to make original discoveries concerning the division of a line segment into a regular partition (Litchfield & Goldenheim 1997).

Changes in the Way Mathematics is Taught

The Sketchpad offers exciting new possibilities for teaching geometry that are consistent with the recommendations of learning theorists and prominent national educational organizations. In particular, the National Council of Mathematics (1989) recommends that mathematics instruction be more exploratory, involve open-ended investigations, and incorporate inductive reasoning. In reality, this approach more closely mimics how mathematics itself is discovered. Mathematicians typically begin with a problem they wish to investigate, use empirical methods and inductive reasoning to formulate conjectures, and finally use formal deductive proof to verify their findings. It would seem logical that mathematics instruction should follow a similar sequence. The *Sketchpad* could provide such an environment.

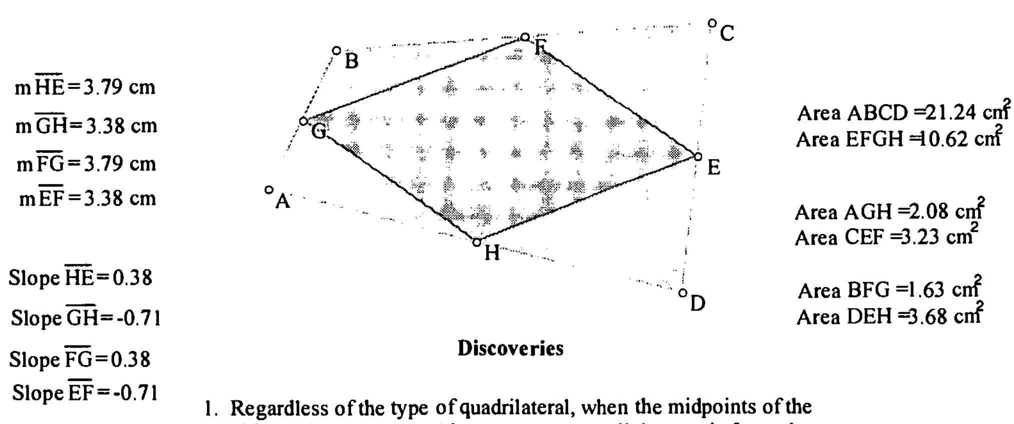
This instructional sequence is also consonant with research on the stages in which children learn mathematics (Piaget 1960, Bruner 1966) and the research on the development of geometric thought by the Dutch educators Dina van Hiele-Geldof and Pierre van Hiele (Crowley 1987). Research has long indicated that mathematical understanding is enhanced when students become physically engaged in constructing and manipulating objects to discover relationships. Additionally, prior to being introduced to formal deductive proof, visual models and inductive reasoning should be used for formulating conjectures. Unfortunately, many geometry textbooks begin with symbolic representations of relationships and focus almost totally on deductive proof, often before students are sufficiently familiar with geometric relationships. Such approaches are now being seriously challenged.

The Origin of the Geometer's Sketchpad

The *Sketchpad* is a product of a National Science Foundation project, the Visual Geometry Project, directed by Dr. Eugene Klotz of Swarthmore College and Dr. Doris Schattschneider of Moravian College in Pennsylvania. The computer programmer who developed the *Sketchpad* is Nicholas Jackiw. The early stages of its development were influenced by hundreds of teachers and students participating in the project. The latest version was released in 1995 and is currently available through Key Curriculum Press. Related materials are now being developed to teach coordinate geometry, trigonometry and transformational geometry using the *Sketchpad.* It continues to be refined, based on input of educators, students, and other geometry users.

A Sampling of Student Explorations

With the construction and measurement tools that come built-in the *Sketchpad*, students make discoveries about the shape formed by connecting the midpoints of the sides of any quadrilateral (See Figure 1.)



Discoveries

1. Regardless of the type of quadrilateral, when the midpoints of the quadrilateral are connected in sequence, a parallelogram is formed.

2. The area of this interior parallelogram is exactly one-half that of the surrounding quadrilateral.

3. The sum of the areas of opposite pairs of triangles is the same, i.e., Area of AGH + Area of CEF = Area of BFG + Area of DEH.

Figure 1: The Midpoints of a Quadrilateral.

Complex constructions are made easy with the *Sketchpad*. The construction shown in Figure 2 is the *nine-point circle* discovered in 1820 by the French mathematicians Charles Grianchon and Jean Poncelet. It is formed by passing a circle through the feet of the altitudes of a triangle, the midpoints of the sides of the triangle and through the midpoints of the segments that join the vertices to the point of intersection of the altitudes.

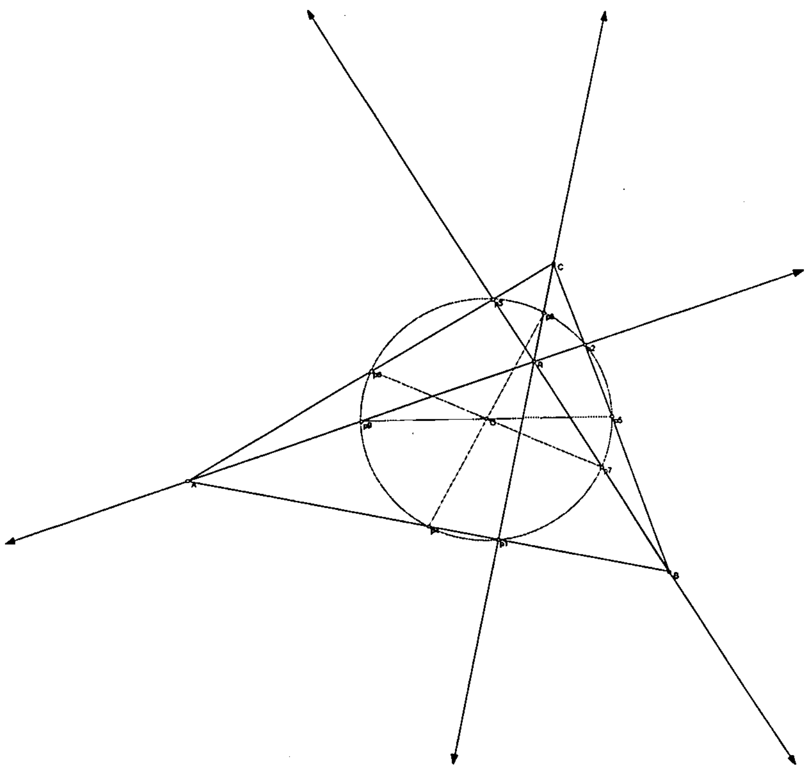


Figure 2: The Nine-Point Circle.

The Euler line (See Figure 3) can be discovered by typical high school students with the *Sketchpad*. Specifically, they find that the circumcenter, orthocenter and centroid of any triangle are always on the same line.

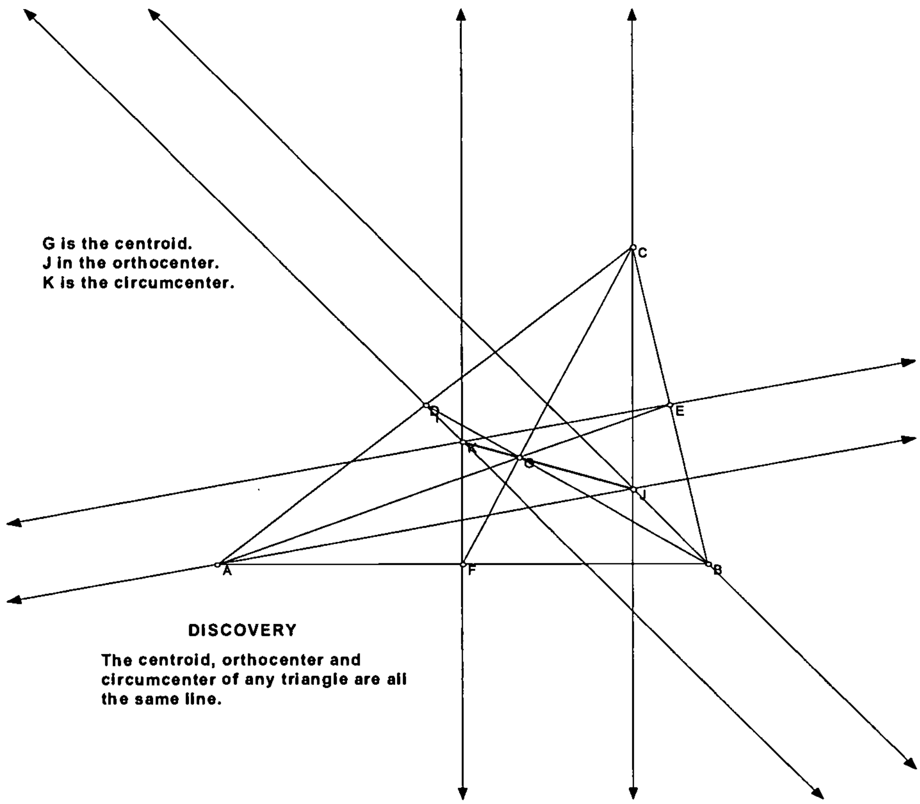


Figure 3: The Euler Line

Students make use of recursive programming in constructing the square root spiral. In this construction, line segments whose lengths are consecutive square roots may be easily visualized. (See Figure 4.)

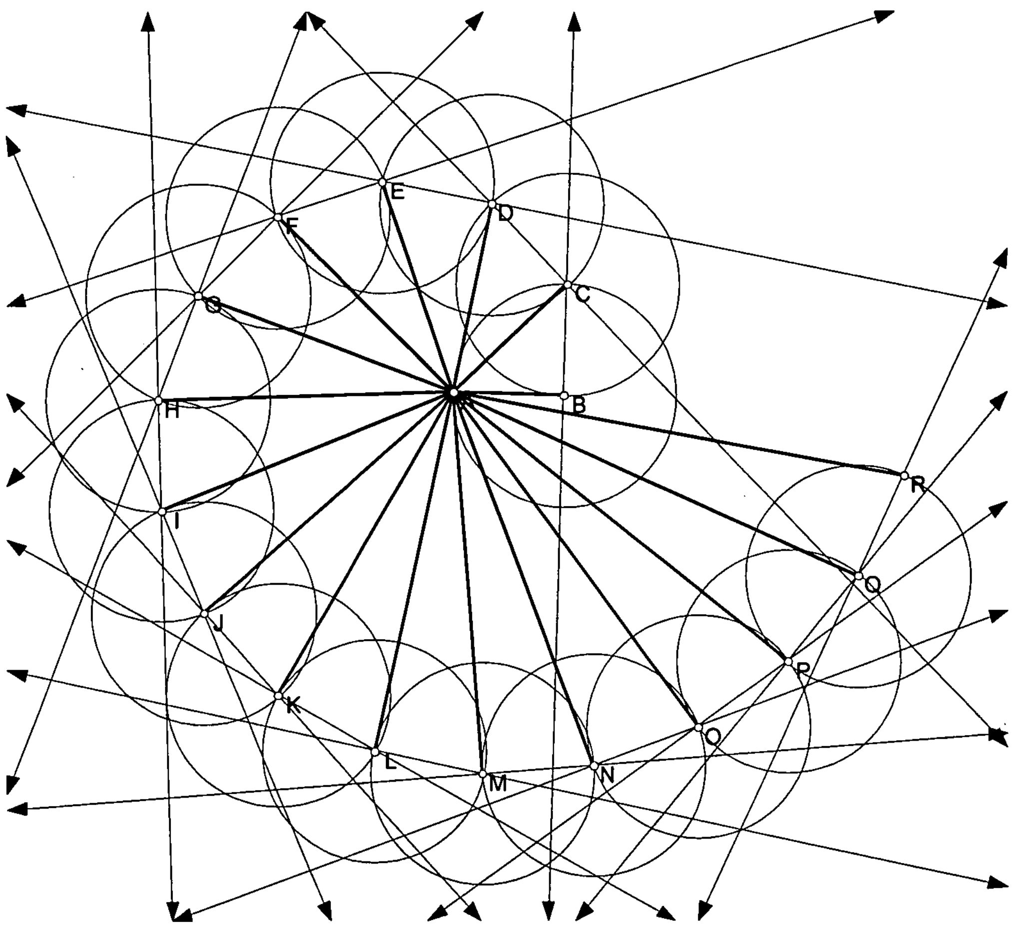


Figure 5: The Square Root Spiral.

A fractal is a self-similar recursive pattern. The study of fractals is a relatively new area of mathematics, recently made possible by computer technology. They can be readily explored using the *Sketchpad*. Ordinarily, they involve too many constructions to make their study feasible. The well-known fractal, Sierpinski's Gasket, is shown in Figure 6. It is formed by continuing to connect the midpoints of the sides of triangles, omitting the center triangle.

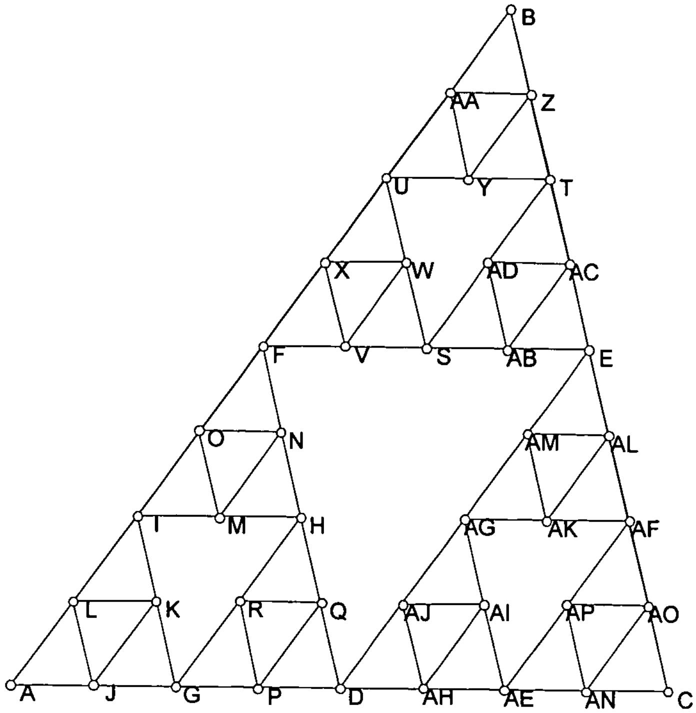


Figure 6: An Example of a Fractal: Seirpinski's Gasket.

Conclusion

The opportunities for student discoveries and explorations using the *Sketchpad* are limitless. My students and colleagues are enjoying discovering geometric principles, many for the first time. The examples shown here just begin to scratch the surface. This software has all of the features for effective instruction and is consistent with research findings on how students learn geometry. It is both a graphics package and measurement tool that is interactive and dynamic. If used effectively, it will surely affect mathematics instruction and learning at all levels.

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Professional Development for Technology-rich Mathematics

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Abstract: Two "all-purpose" technologies, Computer Algebra Systems (CAS) and the Internet were used in a professional development course for secondary mathematics teachers. The teachers learned to use the CAS software in rich problem-solving situations and communicated at a meta-level within an electronic forum. Here we explore the didactic strategies that make effective use of these technologies with various *Magic circles* constructed by composing linear functions.

Introduction

Mathematics teachers today have access to a range of technologies to aid in teaching including Computer Algebra Systems (CAS), personal computers, and the Internet. Heid (1997) has discussed the potential impact of these technologies on the reform of mathematics education. Computer Algebra Systems are thought to play a major role in this reform, since they require students to use concise symbolic language and to understand the underlying mathematics of a given topic. Moreover, interpreting the output of a graphic display involves recognizing equivalent forms of non-graphic representations and judging if the results are reasonable. Noss and Hoyles (1996) suggested using the computer as a window that shows the multiple ways that mathematical meanings are constructed. They coined the term *Webs of Meaning,* explaining that "The idea of *webbing* is meant to convey the presence of a structure that learners can draw upon and *reconstruct* for support - in ways that they choose as appropriate for their struggle to construct meaning for some mathematics". Researchers have dealt extensively with the issue of making sense in mathematics, and the contribution of technology in this regard. Schoenfeld (1992) pointed out that learning to think mathematically means developing a mathematical point of view and applying it for understanding mathematical structures. In order to prepare teachers to teach with modern technology, Balacheff (1993) suggested that teachers be provided with opportunities to experience mathematics from a mathematician's point of view, and to experience technology from a didactical point of view. DiSessa (1997) has provided such opportunities by introducing a new class of software entitled "open toolsets" that involves a highly modifiable, extendable number of units capable of being combined with each other. He has claimed that open toolsets "meet teachers half way" by allowing more substantial control over the technology, thus enabling open toolsets to become a flexible base for learning and instruction that grows and can continue to grow organically.

An inservice course was designed to enhance teachers' communication and problem solving skills, using two "all-purpose" technologies, CAS and the Internet. The course was given to 30 teachers. One of the problems that the teachers explored in the course was *Magic circles.* We had previously dealt with the problem at the pre-computer age (Zehavi and Bruckheimer 1982), and when we returned to the problem using the CAS software *Derive* (Soft Warehouse), new Webs of meanings were opened. Magic circles involve a rich variety of mathematical structures, concepts and ideas, such as composing linear functions, inverse functions, fixed points, group theory, complex numbers, and vectors. Given a closed circle of 10 linear functions, we begin at the top of the circle and substitute a number of our choice. The outcome is

substituted in the next expression and so on, proceeding clockwise, until we complete the circle, and the final output turns out to be the same number with which we started (see Fig. 1).

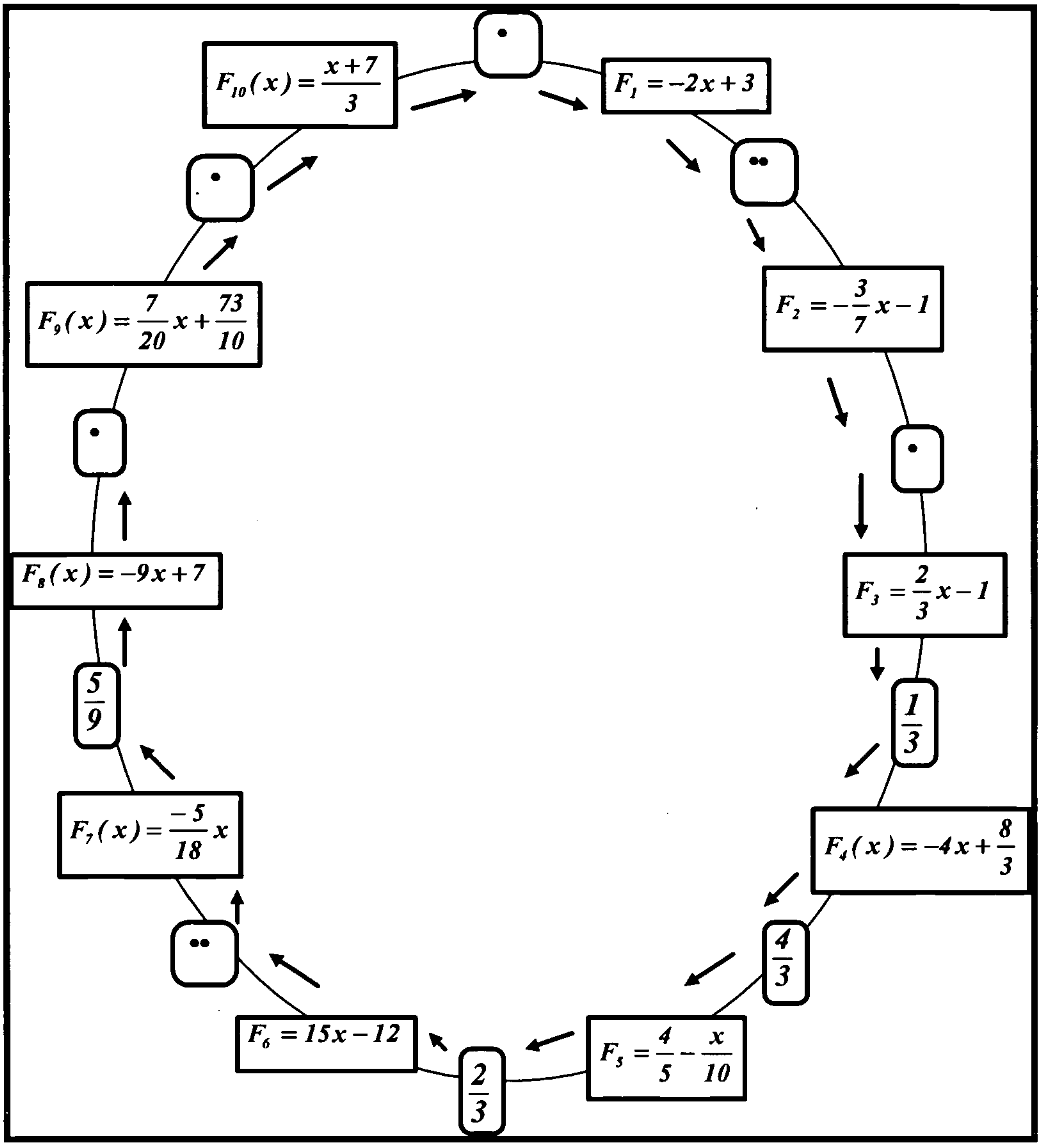

Figure 1. A closed circle

Now we pose several problems:

1. If we start with any number and proceed clockwise, in a given circle, will we always finish with the same number with which we started?

2. If we break the circle at any other point (function), substitute a number, proceed clockwise and complete the circle at the new point of entry, will we always finish with the same number with which we started?

3. Do you know how to construct such *closed circles*?

4. If we traverse the circle counterclockwise will we end up with the same number with which we started?

5. Is it possible to construct *magic circles* such that if we traverse them in either direction, the output is the same as the input?

6. Do you know how to construct magic circles such that after only two completed circles the output will be the same as the input?

7. Is it possible to construct magic circles such that after only K completed circles, the output will be the same as the input?

Several possible approaches to the problems can be applied, each involving meaningful mathematical activity. The teachers who participated in the course submitted their answers via electronic mail or posted them on URLs. In addition, the teachers were part of an electronic forum that communicated at a meta-level as follows:

Reflection – Comments on other students' solutions.

Discussion – Is there an interesting mathematical structure/representation regarding the solution of the problem?

Extension – Add an exercise related to the problem; explain the goal of the exercise.

The forum activities improved from problem to problem. By commenting on the answers of the participants, the teachers learned from each other and enlarged the body of knowledge related to each problem. In the following section we show examples and analyze teachers' communication at this meta-level.

Communicating Mathematics Effectively

Among the participants in the course were 6 teachers who maintained an algebraic approach throughout the problem solving process. Here is a sample of their work in constructing *magic circles* (i. e. if we traverse them in either direction, the output is the same as the input).

Given ***n*** linear functions

$$F_1(x)=a_1x+b_1,\quad F_2(x)=a_2x+b_2,\quad \dots\quad F_n(x)=a_nx+b_n$$

the composition of all the n linear functions can be written as

$$F_n(F_{n-1}(F_{n-2}\ \dots\ F_3(F_2(F_1(x)))\dots))=$$

$$a_na_{n-1}\dots a_2a_1x+a_na_{n-1}\dots a_2b_1+a_na_{n-1}\dots a_3b_2+a_na_{n-1}b_{n-2}+a_nb_{n-1}+b_n=$$

$$a_na_{n-1}\dots a_2a_1x+F_n(F_{n-1}(F_{n-2}\ \dots\ F_3(F_2(b_1))\dots)).$$

The necessary and sufficient conditions needed for the general magic circle are

1. $a_na_{n-1}\dots a_2a_1=1$

2. $a_na_{n-1}\dots a_2b_1+a_na_{n-1}\dots a_3b_2+a_na_{n-1}b_{n-2}+a_nb_{n-1}+b_n=0$

3. $a_1a_2\dots a_{n-1}b_n+a_1a_2\dots a_{n-2}b_{n-1}+a_1a_2b_3+a_1b_2+b_1=0.$

Clearly, it is possible to declare only three coefficients as variables and choose values for the rest, then solve a system of three linear equations using *Derive*. This procedure produces magic circles easily. Some

participants commented that these teachers merely used the symbolic mechanism of the CAS without gaining any insight into the mathematical concepts. Indeed there can be a problem when using CAS the symbolic manipulator of the CAS without using the other tools associated with it, and without opening windows of mathematical meaning.

As indicated in the last paragraph, most of the teachers related the construction of *closed circles* to the fact that the linear functions $y = ax + b,\ \ a \neq 0$ form a group with the composition of functions as an operation. This helped them in determining an efficient method for building circles: choose any $n - 1$ linear functions, their composition is a linear function, a linear function has an inverse, the inverse function is the n^{th} function of the circle. Five teachers were able to justify the "breaking of the circle" feature of a closed circle by using the associative property of function composition. Regarding the construction of magic circles, most of the teachers were aware that the group of linear functions with composition is non-commutative, and that makes the task difficult. They tried to get some ideas from the graphical representation. Some of them realized that commutative subgroups of linear functions are formed by the set of all functions with the same fixed point (or with no fixed point). But this method is based on sufficient conditions only. With some hints from the instructors they discovered a general method that integrates various structures, concepts, and mathematical ideas.

New Webs of meaning were opened to most of the teachers while they worked on *magic circles of order k*. Some teachers referred to Demoivre's theorem for complex numbers. Others, who teach computer science as well, introduced the *iteration function* of *Derive* to perform the composition of function on itself K times. The teachers commented on each other's originality in creating meaningful representations. To conclude this section we present a creative and original representation, accomplished by two teachers who teach junior high school. Their motivation was to be able to present some parts of the problem to their students. Since the standard mathematical notation for composing functions is too abstract, they chose to replace it by a more "explicit" notation (see lines #2 - #4 in Fig. 2). In the graphic window of Fig. 2 they illustrated graphically how a closed circle of three function matches the number 10 to itself.

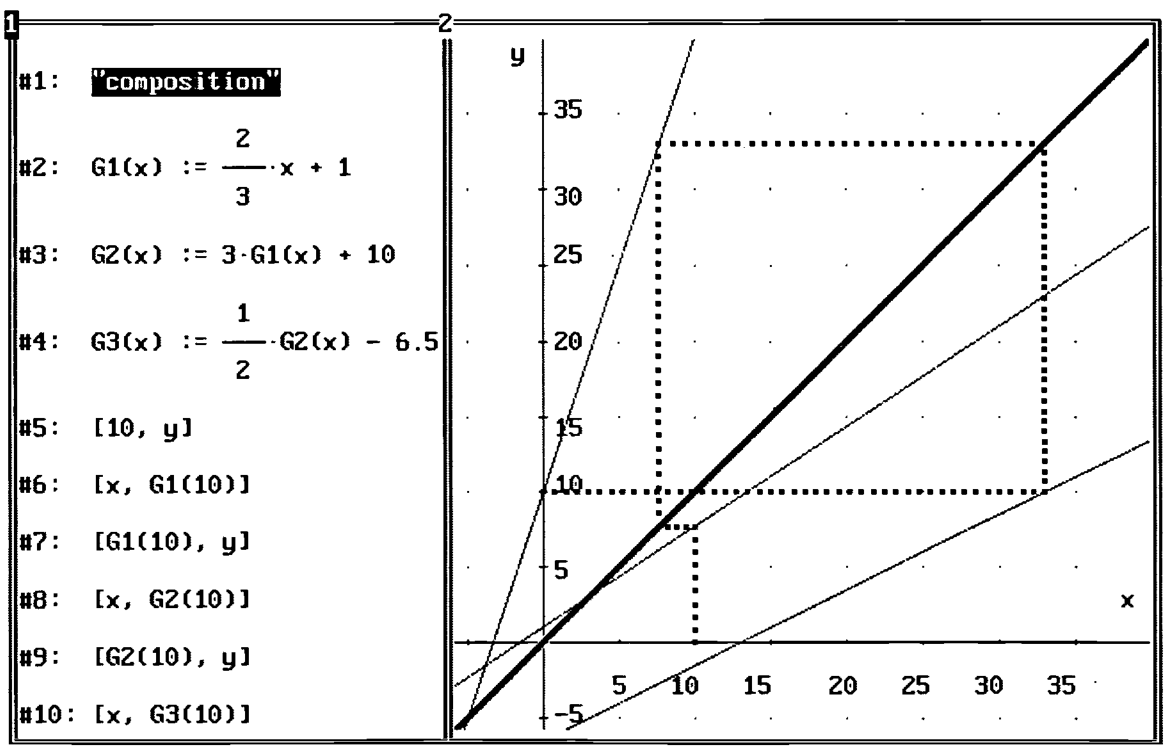

Figure 2. A creative representation of a closed circle

A Concluding Remark

Nowadays,, when many teachers have computers at home, CAS technology became available on PCs, and the Internet came into our lives, new opportunities were opened for professional development. We can therefore put interesting and exciting problems on the Web and hyperlink them to relevant sources and to relational hints referring to mathematical concepts and ideas. Such problems may encourage teachers to explore mathematics creatively and in depth, and to communicate such mathematical activities to their colleagues and to their students using these technologies.

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NEW MEDIA

Using Videotape Vignettes to Enhance Inservice Teacher Perceptions of Computers as Tools for Student Learning.

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Abstract: This study was conducted to examine the effectiveness of using videotape to enhance inservice teachers' perceptions of computers as tools for instruction. The function of the videotapes was to set a context for classroom technology use prior to instruction in the use of selected computer tools. The inservice teachers responded positively to a combined video/ hands-on activity instructional sequence. They indicated that the intermingling of videotape and computer instruction provided an effective strategy for introducing technological tools to teachers.

The NCATE guidelines developed by the International Society for Technology in Education (ISTE, 1996) advance the use of technology as a tool for teachers and learners. Performance indicators regarding the use of productivity tools by teachers and performance indicators promoting specific teaching methodologies recommend that teacher preparation programs demonstrate appropriate technological tool use within the courses and experiences they provide their students. The productive use of technological tools and the successful implementation of teaching methods that incorporate technology imply a "hands on - minds on" approach for developing skilled technological tool users.

Three factors; goals, methods, and materials are essential for all forms of skilled tool use. The three factors are intertwined with the first factor, goals, suggesting the methods to apply and the materials to employ. Proficient tool users are able to choose a suitable tool for a task because they understand the goal of the task. The selection of a suitable tool is a critical first step but one must also be proficient in the methods of the tool selected. Inappropriate application of the tool insures that the target goal will not be achieved satisfactorily. Consequently, preparation in the basic methods of any tool is a prerequisite to its skilled use.

Awareness of goals and skill in tool methods though essential are insufficient without a consideration of materials. The tool user must understand the nature of the materials he/she is about to act upon. In typical circumstances, skilled tool users comprehend the strengths and limitations of the materials they are provided and adjust their tool selection and execution accordingly. For example, the cabinet maker selects different chisels when working with various woods to avoid damaging the finish. The auto mechanic uses various wrenches to simplify reassembly of a motor. In classroom practice, the same is true. Informed classroom teachers consider the dynamic nature of student learning and the complex nature of the content to be transformed before they decide what, if any, technological tool will apply. In the classroom, students and academic content embody the factor of materials. Goals, methods and materials are all important. The skilled teacher acknowledges the interrelationships among the three factors and implements technology accordingly.

The common expression, "To a man with a hammer every problem looks like a nail," rings true concerning the classroom use of technology. The teacher with minimal knowledge of technological tools is likely to choose the only tool he/she is familiar with for a task. The choice may prove to be the wrong tool for the task. This in turn leads to unsatisfactory results and a subsequent loss of interest in applying technological tools in the classroom. Part of this problem of tool selection and implementation rests with teacher preparation programs that focus on the "how " of technological tool use rather than the "why." Even in instances where education faculty indicate that they have considerable personal experience with computers, survey data reveal that they do not integrate technology into their teaching (Strudler, Handler, and Falba,

1998). This problem of a lack of modeling is compounded by the reality that teachers frequently teach as they were taught (Lortie, 1975). As such, models for the classroom use of technology continue to be elusive for many teachers.

Appropriate technological tool implementation in the classroom will remain lacking until greater focus is placed on the "why" of technological tool use. Constructivist epistemology of learning proposes that knowledge or meaning is constructed by individuals through their experiences in a particular context (Honebein, Duffy, and Fishman, 1993). Linking the actual practice of technological tools to the context of an authentic learning environment suggests one method to encourage teachers to consider the "why" of technology use. Practice in context deflects emphasis away from technique back to the purpose of tool use. The consequence of placing learning in a larger functional context makes practice more meaningful. The use of an authentic learning environment alters experiences with tool methods from rote practice into an apprenticeship experience. The use of an authentic learning environment in teacher preparation also addresses the issue of modeling since as Lortie (1975) suggests teachers who participate in learning experiences are more likely to engage their students in similar experiences.

How does one address the issues of providing an authentic learning context and modeling technological tool use while furnishing guided practice in the use of technological tools? Experiences with video cases led to the sentiment that video vignettes offer a starting point for establishing a context for classroom technological tool use. (Abate, Atkins, Benghiat, Hannah and Settlage 1996). At Cleveland State University, a videodisc on conversational elements was implemented in a elementary science course. The students in the course viewed short vignettes from a two day science lesson. Next they collected data regarding the techniques used by the instructor in the vignettes, discussed their findings as a class and then began the development of micro lessons to be taught to their peers. The video, discussion, lesson development activity proved effective in reinforcing students use of instructional conversation elements in their classroom teaching (Abate, et al. 1996)

One way to establish an authentic learning environment is to take an existing "real world" learning experience, reduce it to its essential features and provide a scaled version of the experience to students as a classroom simulation. As Jones (1987) has commented, the fundamental reason for using simulations in the classroom is that students make mistakes when learning new content. Mistakes are inevitable but they can prove desirable. In a well designed simulation students learn from their experiences in a risk reduced environment: An environment that also reflects a real world situation. The knowledge and skills they develop are learned in context. In a simulation mistakes become opportunities for real learning. For this reason, it was concluded that "hands-on" activities that simulate comparable K-12 learning activities be developed to complement the video vignettes. The second reason for considering simulations was that for teachers the simulations would provide opportunities for practice in the technology tool in conjunction with participation in appropriate tool related learning activities. Combined with the video vignettes, the simulation learning activity would provide opportunities for guided practice with one or more technological tools as well as an orientation to and practice with technological tools in an authentic learning context.

Background

Graduate courses in the Computer Uses in Education program at Cleveland State University (CSU) model instructional strategies supportive of the ISTE guidelines (ISTE, 1996) However, students who are new to the program have limited experiences with technology. Consequently, teachers with novice skills concentrate on the methods of tool use at the expense of understanding the goals of the use or the connection of the tool to the instruction of academic content. It was proposed that a series of videotapes documenting the use of technological tools in the context of K-12 classrooms and comparable classroom activities be created to deflect emphasis away from technological skill acquisition toward purpose and content while providing a model for classroom implementation.

Those that can ...do technology (Abate, 1999) are a series of videotape vignettes and instructional materials developed for use in the CSU graduate Computer Uses program. The video/activity learning materials were based on the following five principles:

1. Accentuate the goals of student learning. Four categories describe the types of learning goals presented in the videos. The categories are; communication, data collection, data analysis and design. The categories are not mutually exclusive. Each of the categories includes sub-categories and sub-types. For example, communication may be visual, text, oral, or a combination of forms. Visual communication may be further subdivided into print based, computer based, or projected media.
2. Integrate the use of technological with traditional classroom tools. To maintain a focus on student learning both the videos and the activities include a continuum of no / low technology through high technology.
3. Promote the simplicity and utility of the technological tools. The technological tools selected for inclusion represent established technologies. Cutting edge technology and classrooms with university support staff were eliminated from consideration during development of the video materials. Also, since a goal of the materials was to provide an introduction to technological tools it was important to provide learning activities within the grasp of the targeted teacher audience.
4. Employ examples of tool use by both teachers and students. Teachers and students equally at ease with the technology were recorded in the videos. Lesson activities designed for use with the video include technology responsibilities for both the faculty member and the teachers.
5. Provide examples from a variety of K-12 settings. All of the videos were recorded in public school classrooms. They include elementary, middle and secondary classrooms from urban, suburban, and rural schools. Although some of the lessons use a computer lab, the instructor of record is the classroom teacher, not the computer laboratory instructor.

Instructional Materials

Two video vignettes from the *"Those that can ...do technology"* series; Microcomputer Based Laboratories (MBL) a middle school science and math video and Computer Aided Design (CAD) a secondary mechanical drawing video recorded during 1997/98 were selected as the initial test cases for teacher examination. In each video, the students were presented with a problem that they were required to solve using traditional and technological learning tools. In MBL, the students were asked to design packaging for a fictitious product. The posed problem required that the students apply the science concepts of conduction, convection, and radiation they had learned earlier. Part of the specifications for the package included an insulation test using MBL temperature probes. All production and material costs for the final package were recorded using calculators and spreadsheets. Students worked in teams to solve the packaging problem. In CAD, the secondary students who already had experience with mechanical drawing and AutoCad undertook a community service project to recreate furniture from a two hundred and fifty-year old school house. Students created sketches and performed hand measurements to produce drawings of historically accurate classroom furniture, they employed AutoCad software to design the individual items and then constructed the items in a school workshop.

Coordinated with each of the video vignettes was a packet of technology based instructional materials that amplified one or more of the technological tools presented in the videos. The instructional activities required that inservice teachers apply technological tools to solve a similar problem. Each problem was simplified to allow for completion and discussion of the instructional activity within a two hour time constraint.

Using a variety of construction supplies, Lego LOGO™ and a ClarisWorks™ spreadsheet, the MBL instructional materials provide a simplified version of the packaging problem. The CAD instructional materials implement the Draw and Paint utilities available in ClarisWorks, clip art and traditional art supplies in the design and layout of a computer lab.

The Investigation

The goal of the investigation was to develop a general impression of the efficacy of video/activity instructional approach. The perceptions of inservice teachers were collected using a questionnaire and open ended response form. To simplify data collection the sample size was kept small. Eleven volunteers with little or no technology background from a graduate Instructional Development class and 11 volunteers with

various levels of technology experience in their first class in the CSU Computer Uses in Education program viewed either the MBL or CAD video vignettes, participated in a group discussion and problem solved in the related learning activity. The volunteers then responded to questions regarding their impressions of the approach. An open ended question asked the students to indicate if they believed the approach to be useful and to explain why or why not. The students also completed a ten question survey with a five point scale ranging from 1-Poorly to 5-Very Well. The ten questions were:

1. The video/activity modeled an appropriate use of technology.
2. The video/activity provided a motivation for learning the technology presented.
3. The instructional activity complemented the video. (It made the purpose of the tool use clearer?)
4. Although I may not teach the content presented in the video, the video/activity made a reasonable case for using technology as a tool for this type of student learning.
5. The video encouraged me to consider other ways of implementing technology in the classroom.
6. The video/activity sequence encouraged me to think more about the why of technology use rather than the how to aspect of using technology.
7. The post video discussion proved useful in understanding technological tool use.
8. The video encouraged me to look at how technological tools relate to student learning.
9. The video encouraged me to consider technology from the standpoint of the student.
10. I would consider using or producing activities similar to the one presented here with my students. (Assume for the survey that you are responsible for the curriculum presented in the learning activity)

Results

The written responses were positive and the average score across the 10 survey questions was 4.05 indicating that the students responded favorably to the instructional sequence. (Fig. 1) There were differences between the two groups with the teachers from the Computer Class averaging 4.17 across all items and the Instructional Development teachers averaging just below 4 at 3.92. The survey was not designed to determine if the differences were significant as the groups viewed separate videos and completed different technological tool activities. However, regardless of the lesson considered or the students familiarity with technology the overall scores and student comments suggest that the students perceived the instructional sequences as worthwhile.

The students responded most favorably to question 4. It averaged at 4.52. The students believed that a reasonable case was made for using technology for student learning in the video and activity provided. One student remarked, " I think it would be useful for industrial arts instructors definitely. Teachers of subjects further removed from the drafting area would find it harder to apply to their particular area. However, the video does show how I can be creative in this approach to using technology."

The Instructional Development students scored question 8., how technological tools relate to student learning, at an average of 4.23 with the Computer Uses students scoring it at 4.55. The difference in scores may be attributable to the difference in focus between the two videos. Again, the written comments mirrored the survey. Comments included, "I felt you could actually perceive the learning taking place from the actions of the students" and "Participating in the hands on activity at the computer followed or preceded by the physical construction of an object or test puts the teacher in the student role"

The lowest scored item was question 7. involving the post video discussion. Expediting the discussion to provide time for students to work on the activities may have contributed to the lower score of this question.

All other questions were scored close to 4.0. The standard deviations ranged from a low of .66 on question 4., the highest rated item, to a high of .96 on question 6. regarding whether the materials encourage the student to consider the why rather than the how of technology. As expected by the standard deviation on this question, some comments were very positive. Students commented, "I believe the video will be helpful in thinking through technology and how it can be used in the classroom.", "The use of technology in this classroom was vital not enrichment; as it is used in most classrooms today," and "While technology is

important the real learning seems to come from the manner the instructor approached the students and the value the students placed on being productive."

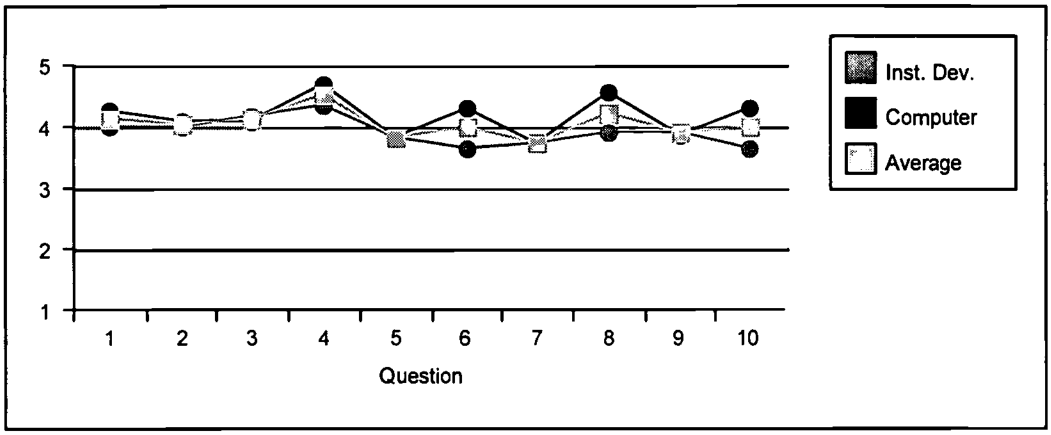

Figure 1. Student Responses to Questionnaire.

Conclusion

In regard to the videos, student comments indicate that technical issues require correction. The quality of the audio made it difficult for some students to follow the process. " I could not understand in many instances what the students were saying or what was the question posed to them." The issue of audio quality must be addressed for the videos to be effective. Although most students indicated that the lessons portrayed in the video were understandable, several requested a further introduction / history of the lesson prior to screening to prepare them for viewing.

Few comments were made regarding the learning activities associated with the videos. The participants were volunteers. The learning activities were not tied to their course assignments. Also, it is possible that the learning activities were not scrutinized as critically as the videos since students were not required to discuss their learning experiences prior to completing the survey questionnaire. Additional feedback is required on the learning activities before a conclusion regarding their efficacy can be established.

It was difficult for all the teachers to go beyond the literal examples portrayed in the video. It is possible that an improved discussion format might diminish some of the problem with a literal interpretation or possibly multiple activities tied to specific content areas need to be developed to meet the individual needs of the teachers. Use of the other video/activity sequences may offer further insights and possibilities for resolving this problem.

Given the informal nature of the survey it is difficult to generalize beyond the two instructional sequences presented to the students. The student written comments and unsolicited verbal comments offered during discussion and activity were very encouraging and their suggestions for improving the sequences will be used to modify the instructional materials. Further study of the video/instructional activities appears warranted.

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PBL + IMM = PBL^2: Problem-Based Learning and Multimedia Development

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Abstract: An interactive multimedia (IMM) package incorporating problem based learning (PBL) principles has been developed to assist teachers in learning to integrate information and communications technologies (ICT) into their teaching. The development process became a PBL experience for the author as design and implementation issues were met and resolved. This paper describes how the learning that occurred has influenced the final form of the multimedia materials that will be demonstrated in the presentation.

Introduction

Governments in Queensland have demonstrated an ongoing commitment to the provision of information and communications technologies (ICT) for use by teachers and students at all levels in schools. The commitment began in 1984 with a project to provide computer laboratories to support teaching of computer literacy in secondary schools. In 1997 the Schooling 2001 project set systemic targets of one computer for every 7.5 students and the use of computers "in all key learning areas, P-12" (Education Queensland, 1998).

Inevitably there are differences of opinion about what constitutes the ideal provision of ICT in a given context and about how best to ensure the equitable provision of ICT across different contexts. Debate about these issues continues in educational, community and political circles. However, the combination of funding, policy and community expectations has resulted in its being reasonable to assume that teachers and students in Queensland schools will typically have some access to ICT for support of teaching and learning.

Increasingly there are expectations that teachers will consider ICT as an integral part of their planning and implementation of curriculum. These expectations are embodied in documents such as policies, requirements for teachers to demonstrate specific competencies in respect of ICT, and in new syllabus documents that incorporate the use of ICT among recommended learning experiences. There is also broad community support for the notion that preparation for an increasingly ICT saturated workplace requires schools to teach about ICT and for the view that learning may be enhanced through the use of ICT.

Relatively few teachers have had the opportunity to develop more than basic skills in the use of ICT. Even fewer have developed confidence and competence in the integration of ICT into their classrooms. Ongoing professional development and support are essential to assisting them through the necessary transition. There are signs that education systems have begun to recognize and address these concerns through provision of funding and specific programs for professional development although there remains much to be done.

It seems unlikely once employers of teachers have invested resources in the professional development of the existing workforce that they would be prepared to employ new teachers who may not meet their minimum standards for ICT competencies. Hence, it is imperative that teacher education institutions develop programs that prepare beginning teachers to effectively integrate technology into their teaching. Substantial parts of such programs are also likely to be relevant to the professional development needs of existing teachers.

Although basic competencies in the use of personal computer systems and common software will be essential, they will not be sufficient for teachers seeking to integrate ICT. The greater challenge for teacher educators and providers of professional development will involve assisting teachers to learn how to adapt curriculum and pedagogy to incorporate use of ICT. This process will be facilitated by access to examples of effective practice which can be made more widely accessible when presented as multimedia materials which may be delivered by web (Bronack & Kilbane, 1998) or on CD-ROM (Kurth & Thompson, 1998).

Problem-Based Learning and Interactive Multimedia

The potential value of examples of good practice as a component of programs for teacher development in the use of ICT can be supported from a variety of sources. Studies of teacher use of ICT have revealed that support from like-minded peers (Becker, 1994) and opportunities to share the experiences of successful colleagues (Sherwood, 1993) are valued by teachers and may influence their use of computers for teaching. Learning from examples is important in the development of expertise in other fields (Chi & Bassok, 1989; Dreyfus & Dreyfus, 1986) and case methods have been promoted as a valuable component of teacher education (Carter & Unklesbay, 1989; Merseth & Lacey, 1993; Shulman, 1986). Finally it has been suggested (Albion, in press) that teachers' use of ICT may be influenced by their self-efficacy beliefs, that these, in turn, may be enhanced by access to examples of successful practice, and that problem-based learning (PBL) may provide an especially effective vehicle for this purpose. The characteristics of PBL and the background to its incorporation as the underlying design of the *Integrating Technology into Teaching* multimedia materials have been described previously (Albion & Gibson, 1998a; Albion & Gibson, 1998b).

Hoffman and Ritchie (1997) argued that interactive multimedia (IMM) could be used to support and enhance PBL with key benefits in areas such as fidelity, representational richness, and individualization. However, there appear to be few instances of the use of IMM and PBL in combination. Both PBL and IMM are sufficiently widely used that there are conventions and expectations about how each should be implemented and where those differ it is inevitable that there are challenges and tensions to be resolved in achieving a working combination.

In developing the instructional design for *Integrating Technology into Teaching* considerable effort was made to identify and resolve significant tensions arising from the IMM-PBL combination (Albion & Gibson, 1998c). While PBL typically involves students in working with a small group, IMM tends to be used by individuals. Since it appears that a major benefit of the group work in PBL may stem from interchange of different points of view (De Grave, Boshuizen, & Schmidt, 1996) the instructional design provides access to a variety of perspectives in the form of multiple sample responses to tasks. Matching the style of support offered by a PBL tutor is difficult in IMM but scaffolding is offered through decomposition into sub-problems (Savery & Duffy, 1995). One of the common features of IMM is the ease of access it offers to a large collection of resources. Paradoxically, this freedom may result in users overlooking important material. The design uses narrative (Bielenberg & Carpenter-Smith, 1996; Laurillard, 1998) as a device to direct the user through the materials and promote the episodic memory which is important in belief structures (Nespor, 1987). Deep learning should be promoted by drawing attention to important resources at points where they are most likely to be relevant in the context of a problem (Albion & Gibson, 1998a).

Devising and refining an instructional design was an important stage in the creation of a multimedia product. The actual development of the materials presented a series of challenges and it is these problems and the learning that emerged from seeking solutions that are referred to in the title of this paper. The process was, in many respects, a problem-based learning experience for the author.

Developing IMM-PBL Materials

Integrating Technology into Teaching: A problem-based learning approach was originally conceptualized as a self-contained multimedia learning environment which would present a series of problem scenarios related to the integration of ICT in primary school classrooms together with a variety of relevant resource materials (Gibson & Albion, 1996). Because the resources associated with the materials included up to an hour of digitized video, delivery of the entire package via the Internet was problematic and design proceeded on the assumption that a CD-ROM would be produced.

A requirement for accessibility of the final product using both MacOS and Microsoft Windows was important in the selection of development tools. Serious consideration was given to using a web browser such as Netscape Navigator or Microsoft Internet Explorer to access materials which would be developed as web pages (in HTML) with additional media elements supported by plugins such as QuickTime and Shockwave. Although this approach would have met the cross platform criterion, advice from the programming team indicated that the browser security model might prevent storage and retrieval of certain kinds of data on a local hard drive. Ultimately Macromedia Director was selected as a development tool that could produce a cross platform product which would meet the other requirements of the design.

Software development may be undertaken by developing a detailed analysis and specification before any code is written and then creating the product according to the specification or, alternatively, a prototype may be developed from a partial specification and refined on the basis of user response (Senn, 1989). For this project the latter approach was adopted and this paper describes some of the issues that arose and the approaches taken to their resolution. The issues can be placed in two groups, those that provoked reconsideration of design elements and those that required technical resolution.

Design Issues

The first group of issues emerged from the experience of working with successive prototypes of the package. Much of the early design work was at a broad conceptual level. Although the general features of the user interface and the flow of logic through the problem scenarios were sketched out and sample materials for the first module were prepared in advance of any coding, many of the details were left to be determined on the basis of experience with the prototype. Three issues from this group are discussed.

Enabling Text Creation and Editing

Early in the design process it was determined that each problem would be divided into a series of sub-problems as a form of scaffolding and that each sub-problem would be solved through the user producing an artifact based on the types of planning performed by teachers. Because the problem scenarios were predominantly based around the experiences of curriculum planning, many of the artifacts to be produced by users required the creation or editing of text. Although it would be possible for users to prepare their responses with pen and paper, the goal of increasing their confidence in using ICT would be better served by having them use the computer.

Macromedia Director provides for fields in which text may be entered and edited. The text can also be saved and retrieved. However, the default condition as used in the initial prototype offered only the most rudimentary editing facilities and did not include formatting tools to support creation of well-structured documents. The facilities available in a text entry area on a standard web page are, if anything, more limited and do not permit easy saving and retrieval. In the final version some sections do make use of web page text entry fields but these are in contexts (simulated email and web form completion) where the limitations are realistic.

The absence of acceptable text editing facilities was regarded as a significant disadvantage in a package intended to improve the learner's facility with ICT. Developing a more capable, but still limited, editor within the total package was considered and rejected on the grounds that the restricted benefits would not justify the investment of resources. Requiring users to work with a text editor or word processor external to the package offered substantial benefits for formatting and for building confidence with ICT but would add an extra layer of complexity for the user. On balance, it was preferable to work with the limitations of the internal editor for the sake of simplicity.

When the decision was made, for other reasons, to move development to a web-based format, the text editor issue was reviewed. The limitations of working within the text entry area of a web-page were considered too restrictive and it was decided to have users accept responsibility for selection of their own text processing environment and for management of their own files. They were also offered the possibility of accessing prepared files in a choice of formats (Word or RTF) that provided templates or structured starting points for the preparation of their responses. This solution provides a level of support while encouraging users to become more familiar with the use of their own software and thus matches well with the overall goals of the package.

Rendering Text More Accessible

In order to support users in working through the materials, each of the four problem scenarios was decomposed into a series of tasks, 23 in all. As users complete each task they are able to access the feedback which comprises a set of sample responses prepared by six teachers who participated as consultants in the development. Thus there is potentially a total of 138 responses to be viewed. The vast majority, 120, of the tasks invited a response which is presented as text. A few are presented in novel ways and some are quite brief

but the overwhelming impression is of a large volume of text, which, despite the value of the insights it affords into the thinking of teachers, is daunting in its sheer quantity.

The problem in this instance was to encourage users to engage with the sample responses in a way that would promote learning. One advantage of the overall structure of the materials was that the responses relevant to each task were made available immediately after the task was completed and before the next segment of materials was accessed. Thus the materials were actively presented in small quantities at the time when they were most relevant. However, it was possible for a user to bypass some or all of the responses and although they were available thereafter they might not be viewed at all.

To insist on users viewing each response before moving on would detract from the experience of user control and, even then, would not ensure that the material was meaningfully processed. The solution developed in this instance involved the creation for each task of a meta-response that summarized the responses from each of the teachers, highlighted similarities and differences and provided a guide to the key ideas which emerged in the responses to each task. Depending upon the particular responses, the meta-response might include both excerpts from the individual responses and links to key sections of the responses as well as commentary based upon other elements of the package. Users are able to gain an appreciation of the complete set of responses by reading just the meta-response and can chose to view some or all of the detail depending upon their interests and interpretation of the issues.

Promoting Access to Resources

The total package includes the collection of over 100 sample responses to tasks prepared by teachers, over an hour of video comprising segments from interviews with about 20 computer-using teachers including those who prepared the responses, several substantial documents representative of those found in schools and several megabytes of web pages reproduced with permission from Education Network Australia (EdNA, 1998) archives. The latter includes several substantial documents relating to the use of computers in schools and a collection of over 40 case studies of effective use of computers in Australian schools.

With so much valuable material available, the challenge was to assist users to access it in ways that would enable them to make sense of it and to apply it in dealing with the problem scenarios and ultimately in the real world beyond the simulations. Some of the materials including documents and some video segments were slotted naturally into the narrative thread which runs through the problems and the sample responses were handled as described above.

As described elsewhere (Albion & Gibson, 1998a), one of the anticipated benefits of the PBL approach was to reduce the likelihood that users would overlook important resources. Providing an index to the resources would assist users who opted to consult the index when working on a task but depending upon what terms were used to create the index users might still not locate relevant materials. A more active approach was sought and the preferred solution was a context sensitive help system which, in addition to explanations of features available at the current location in the package would clarify the tasks and provide specific coaching hints about how to approach the task with links to resources that might be helpful for the particular task. In the final version, which is constructed for use in a web browser, links to additional resources on the Internet are included. To a limited extent this facility simulates the role of a tutor/facilitator in conventional PBL by challenging and scaffolding thinking about the task.

Implementation Issues

This second group of issues also emerged as prototypes were developed, evaluated and revised. However, they were concerned more with the technical and systems issues of implementation than with the refinement of instructional design features discussed in the previous section.

Specification and Communication

An initial prototype which included many of the key features of the first scenario was constructed in Macromedia Director and used in a limited trial with students (Albion & Gibson, 1998b). Responses from students were very positive and on the basis of the evaluation a more detailed specification for the first scenario was developed. Progress stalled in the face of persistent bugs which resulted in a focus on those segments and a

slow down in the develop-test-revise cycle of prototyping. Lengthy periods between reviews of progress resulted in a second prototype which demonstrated key features of the design but with a flawed user interface which did not implement the revisions specified after the first evaluation.

In order to clarify the intentions of the designers, the author constructed a prototype in HyperCard. Although cross platform issues rendered HyperCard unsuitable for the complete development of the package, it did provide an effective means of communicating a proof of concept and a more detailed 'specification' of the design. The key lesson learned in dealing with this challenge was that software development requires a commitment either to a clear and complete specification developed from analysis of requirements or, if a prototyping approach is followed, a sufficiently short cycle of review and revision to ensure that development does not depart significantly from the requirements of the users.

Web-based Development

During the course of development the emphasis in software development at the University of Southern Queensland shifted towards web-based delivery. Because of the difficulties encountered in the original prototype and the unsuitability of HyperCard for cross platform delivery a decision was made to convert the project for delivery in a web browser. This approach does not preclude delivery on a self-contained CD-ROM but at the same time it introduces opportunities for making at least part of the materials more readily available to a wider audience via the World Wide Web and for providing convenient links from within the materials to additional resources on the Web. Development was undertaken using HTML and JavaScript with the author assuming direct responsibility for much of the development work. Various tools including automated generation of pages from databases and a specialized markup language (Evans, 1998) for creating sets of linked pages from Microsoft Word documents were employed.

Among the challenges in successfully translating the original concept into a web-based product was the achievement of a satisfactory balance between the forward flow of the narrative which underlies the PBL design and the inherent freedom of a web browser to move forwards and backwards through the material. Structurally, each problem scenario is a series of nodes ordered in time by a story line and through which the user moves to complete the scenario. While at each node, the user is free to explore the resources available in the package to support dealing with the series of tasks. Early trials with resources being presented in the same window as the scenario sequence suggested that users might find that approach confusing. Instead the resources are presented in separate windows that open as required. Although this adds complexity, users should learn quickly that extra windows may be closed and reopened as necessary.

Ideally the user should move from node to node only in a forward direction since backtracking can result in a sense of being "lost". Although it is technically possible to present the material in a browser window that prevents return to a previous page, it was regarded as undesirable to interfere unnecessarily with the standard operation of the browser software. Instead, moving forward through the material was made easier by the provision of very visible links in anticipation that users would take the path of least resistance.

Conclusion

In designing and developing a multimedia package using PBL as the underlying design the intention was to encourage students to engage more strongly with the resources in the expectation that this would lead to increased confidence in their ability to work with computers in their classrooms. The validity of this design remains to be tested by evaluation of the completed materials.

What is certain is that, in meeting the challenges that have arisen in the development of the package, the author has acquired first hand experience of the value of problem based learning.

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ELECTRONIC TEACHING PORTFOLIOS

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Abstract: As we move to more standards-based teacher performance assessment, we need new tools to record and organize evidence of successful teaching, for both practicing professionals and student teachers. This session will provide an overview of different electronic portfolio development tools and will introduce a strategy for using Portable Document Format (Adobe Acrobat PDF) files to store and organize Electronic Teaching Portfolios.

1. Introduction

This paper will briefly cover various strategies for authoring electronic portfolios and design for an electronic teaching portfolio, including goals/purpose of the portfolio, evaluation criteria, audience, content, context and multimedia materials to include in the portfolio. One strategy often overlooked in the development of electronic portfolios is the use of Adobe Acrobat 's Portable Document Format (PDF) to gather evidence from a variety of applications. There are other authoring software packages which allow the creation of hypertext links between goals, student work samples in multiple forms of media, rubrics, and assessment. The software used to create the electronic portfolio will control, restrict, or enhance the portfolio development process. Form should follow function as well, and the electronic portfolio software selected should match the vision, style and skills of the portfolio developer, as well as the technology available.

2. Background

A **portfolio** is a purposeful collection of student work that demonstrates effort, progress and achievement; a portfolio provides a richer picture of student performance than can be gained from more traditional, objective forms of assessment. Most traditional standards-based portfolios are 3-ring notebooks, organized with dividers and sections for paper-based documents demonstrating each standard. An **Electronic Portfolio** uses multimedia technology allowing students/teachers to collect and organize portfolio artifacts in many media types (audio, video, graphics, text) with hypermedia links connecting that evidence to the appropriate standards. Students/teachers can publish their Electronic Portfolios on CD-Recordable discs, video tape or the Internet. The benefits of Electronic Portfolios over traditional paper-based portfolios are:

1. Makes student work in many media accessible, portable, examinable, widely distributable
2. Makes performances replayable and reviewable; it is important to see more than once
3. Hypertext links allow clear connections between standards and portfolio artifacts
4. Creating an Electronic Portfolio can develop skills in using multimedia technologies
5. A teacher with an electronic portfolio will be more likely to have students with electronic portfolios.
6. It's easier to manage the portfolio process, especially storage, presentation, and duplication

3. Process for Constructing Electronic Portfolios

At the 1997 SITE Conference, Boulware, Bratina, Holt & Johnson described a process for developing Pre-Service Teacher Portfolio Process which was based on a portfolio development manual published by Campbell, Cignetti, Melenyzer, Nettles & Wyman (1997):

- Distinguish between a working and a presentation portfolio;
- Organize a working portfolio according to standards;
- Identify artifacts that denote accomplishments for each standard; and
- Produce a working portfolio.

In an article that was published in the Proceedings of the National Educational Computing Conference (1997) and updated in the October, 1998 issue of *Learning & Leading with Technology*, I outlined a process for developing electronic portfolios in contrast to the process normally used to develop multimedia presentations:

- decide on goals of portfolio based on learner outcome goals that should be based on national/state/local **standards** with associated evaluation rubrics
- decide on and describe the assessment **context**
- decide on and describe the **audience**(s) for the portfolio (student, parent, college, community?)
- decide on **content** of portfolio items (determined by context)
- decide which software **tools** are most appropriate for the portfolio context
- decide which **storage** and **presentation medium** is most appropriate for the situation
- gather **multimedia materials** to include in the portfolio which represent learner's achievement (preferably linked to standards, preferably in a relational database)
- record **student self-reflection** on work and achievement of goals
- record **teacher feedback** on student work and achievement of goals
- organize with **hypermedia links** between goals, student work samples, rubrics, and assessment
- **present** portfolio to appropriate audience (by student, in age-appropriate situations)
- **evaluate** effectiveness of portfolio related to the purpose and assessment context

3.1. Storing the Working Portfolio

There are many technologies that can be used to store digital portfolio artifacts during the development stages. Some of the most common include:

- Computer diskette
- CD-Recordable (CD-R) & CD-ReWritable (CD-RW)
- Video Tape
- High density floppy (Zip disk)
- WWW or Intranet
- Jaz disk
- DVD-RAM (coming soon)

3.2. Publishing the Presentation (Formal) Portfolio

Many of those same strategies will be used to publish the formal or presentation portfolio, including CD-R, Video Tape, WWW, DVD-RAM . The choice depends on the audience for the portfolio.

3.3. Authoring Tools for Multimedia Portfolios

It is important to choose software tools that allow teachers and students to create **hypertext links** between goals, outcomes and the various student artifacts (products and projects) displayed in multimedia format that demonstrate their achievement. Although there are some very good commercial electronic portfolio programs on the market, they often reflect the developer's style or are constrained by the limits of the software structure. I have found that many electronic portfolio developers want the freedom to create their own portfolio structure using appropriate off-the-shelf software.

3.3.1. Generic Construction Tools (off-the-shelf software)

There are a number of generic types of software with examples shown of brand name products.

- **Relational Data Bases**, such as FileMaker Pro 4.0 or Microsoft Access
- **Hypermedia "card" formats**, such as HyperStudio, HyperCard, Digital Chisel, or SuperLink + commercial electronic portfolio templates available.
- **Multimedia authoring software**, such as Macromedia Authorware, Macromedia Director
- **Network-compatible hypermedia**:
    - **HTML/WWW** Pages
    - **Adobe Acrobat** (PDF)
- **Office "Suite" Multimedia slide shows**, such as Microsoft PowerPoint, AppleWorks

3.3.2. Commercial Portfolio Software Packages

There are several commercial software packages that I think are appropriate for electronic teaching portfolios:

- **Grady Profile** (Aurbach & Associates) http://www.aurbach.com/ - a brand new **Teacher Portfolio**
- **Persona Plus** - http://www.personaplus.com

4. Skills for developing Electronic Portfolios

The skills necessary to develop an electronic portfolio are the same for developing multimedia presentations. Below is a list of topics for training sessions that are being offered to students at the University of Alaska Anchorage School of Education, to develop Electronic Portfolios, using Adobe Acrobat and either CD-ROM or video tape as the publishing medium.:

1. Converting files from any application to PDF using PDFWriter or Acrobat Distiller
2. Scanning/capturing and editing graphic images
3. Digitizing and editing sound files
4. Digitizing and editing video files (VCR -> computer)
5. Organizing portfolio artifacts with Acrobat Exchange, creating links & buttons
6. Organizing multimedia files and pre-mastering CD-ROM using Jaz disks
7. Writing CD-Recordable disc using appropriate CD mastering software
8. Recording computer images with narration to video tape (computer -> VCR)

5. Electronic Portfolios and Standards

As I attend presentations at national and regional conferences, I see a lot of variations on the technologies used to develop electronic portfolios, but very little linkage to the actual benchmarks that students are supposed to be demonstrating. Too many of the current examples of electronic portfolios, both "classroom-grown" and commercial, focus on the glitz and glamour of high tech multimedia; very few commercial programs provide the capability of directly linking students' digital portfolio artifacts to the standards for which they demonstrate achievement. Most states have adopted standards for both students, practicing teachers, and new teachers. These standards form an ideal framework for organizing an electronic portfolio. I propose that a portfolio without standards is just a multimedia presentation or a fancy electronic resume or a digital scrapbook. Without standards as the organizing basis for a portfolio, the collection becomes just that...a collection, haphazard and without structure; the purpose is lost in the noise, glitz and hype. High technology disconnected from a focus on curriculum standards will only exacerbate the lack of meaningful integration of technology into teaching and learning. *(portions of this section were originally published in the Proceedings of the Tel-Ed 98 Conference)*

6. Conclusions

Electronic portfolios are a unique way to document student progress, encourage improvement and motivate involvement in learning. There are a variety of tools for constructing electronic teaching portfolios. The choice of software can either restrict or enhance the development process and the quality of the final product. I have posted another web-based article (noted in the Web References below) which outlines in more detail the advantages and disadvantages of each of the "off-the-shelf" development tools. Online research using these tools is now being conducted to determine the best technological strategy to use, based on a variety of human and technological factors. Results will be reported at future SITE conferences and posted on-line at http://transition.alaska.edu/www/portfolios.html.

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1	2	3	4	5
Limited experience with desktop computer - able to use mouse, menus, run simple programs	Level 1 PLUS proficiency with a word processor, basic e-mail and Internet browsing; enter data into a pre-designed database	Level 2 PLUS able to build a simple hypertext (non-linear) document with hypertext links (using either a hypermedia program like HyperStudio, Adobe Acrobat Exchange, or an HTML WYSIWYG editor)	Level 3 PLUS able to record sounds, scan images, output computer screens to a VCR; design an original database	Level 4 PLUS multimedia programming or HTML authoring; create QuickTime movies live or from tape; program a relational database

Table 1: Level of Teacher Skill (Relative Ease of Use)

1	2	3	4	5
No computer	A single computer with 8 MB RAM, 80 MB HD, no AV input/output	One or two computers with 16 MB RAM, 250+ MB HD, simple AV input (like QuickCam)	Three or four computers, one of which has 32+ MB RAM, 500+ MB HD, AV input and output, scanner, VCR, video camera, high-density storage device (such as Zip drive)	Level 4 PLUS CD-Recorder, at least two computers with 48+ MB RAM Optional: video editing hardware and software

Table 2: Level of Technology Required

	Relational data base	Hypermedia "card" file (including templates)	Multimedia authoring software	WWW Pages in HTML	Acrobat Reader (PDF files)	Integrated "Office" Software Slide Shows	Proprietary software
Common development tools	FileMaker Pro	HyperStudio Digital Chisel	Macromedia Authorware, Director	Adobe PageMill, Claris Home Page	Adobe Acrobat Exchange 3.01	Microsoft Office, Works, AppleWorks	Grady Profile Persona Plus
Structure & Links	Structured fields/records/ files linked together by common fields	Electronic cards (screens) linked together by "buttons"	Icon-based or time-based multimedia authoring environment	WWW pages viewed with a Web Browser (Netscape or Explorer) using links created in HTML	Postscript-based pages that can be navigated sequentially, or using bookmarks, links, or buttons	Slide Shows (i.e., PowerPoint)for presentation or "Binder" (Office) to link documents together	Varied: Grady Profile has Hypercard base Persona Plus uses relational database engine
Player available	Yes	Yes	Self-contained	Browser (free)	Reader (free)	Yes (PowerPoint) No (AppleWorks)	Yes (Grady) ? (Persona)
Advantages	Flexible reporting Network-friendly Web accessible Cross-platform	Widely accessible in classrooms Construction tools included	Most flexibility in development CD-ROM Cross-platform	Web-accessible Cross-platform	Web-accessible Cross-platform Create files from any application Ideal for CD-R	Widely accessible software. Cross-platform	Pre-designed and structured
Dis-advantages	Limitation of size of files Requires player	Not web-accessible View limited to screen size	Steep learning curve	Multimedia (video) not well integrated Complex authoring	Size of files Limited construction tools	Not directly web-accessible Ease of creating hypertext links. Requires original application to read.	Grady: not Web-accessible, Mac only, inflexible Persona: highly complex
Ease of Use* (Table 1)	4 to develop 2 to use	3 to develop	5	2 with editor 4 without	2	3	2 (Grady) ? (Persona)
Technology Required (Table 2)	3	3	5	4	4	3-4	2 4
Cost (with Ed. discounts)	$49	$39-$199	$150-$1,000	$49-$79	$49	$49-$500	Grady $199 Persona ?

Table 3: Comparison of Portfolio Construction Tools

Thanks Grandpa!
I Finally Learned Something From A TVCommercial

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Abstract

The paper is designed to showthe steps, equipment and timeline needed in order to create CD-ROMs for usein public school physical education classes. A CD-ROM, which was developedat AUM, and used to teach skills needed to play softball will be demonstrated. The ability to use Quick Time video to offerstill-frame and reverse motion video will be demonstrated. The equipmentneeded to create the videotape, digitize the video, and master the CD-ROMwill be discussed. Costs for the various equipment utilized will be covered. The steps needed in order to developQuick Time movies from "raw" videotape will be discussed. Attendees whoreceive this information will have the steps and knowledge necessary toreturn to their schools and develop CD-ROMs for use in their own physical education programs. A list ofequipment and software, as well as a proposed list of step-by-stepinstructions for creating their own CD-ROMs for use in physical educationand other classes, will be provided.

Recently, a television commercial aired whichshowed a very dejected young man attempting to play baseball.Unfortunately, his best efforts produced few good results. An oldergentleman, who I like to think of as his grandfather, notices hisgrandson's dejection. Using the CD-R in his computer at home, hetakes video of baseball players and masters a CD-ROM which he then sends tohis grandson. The grandson watches the CD-ROM and, in typical commercialfashion, gets a hit the next time he is up to bat. As I watched this

commercial, I began to wonder if theinclusion of CD-ROM technology into the physical education class in publicschools would work as well as the "life-affirming" tv commercial. Thispaper is designed to show the equipment, timeline and steps needed in order to create CD-ROMs for use in publicschool physical education classes.

Equipment

Until very recently, the cost has beenprohibitive in most public school settings for the equipment needed tocapture, digitize and edit video, and burn CD-ROMs. Computers which werepowerful enough and software which was easy enough to use by most typical computer users did not exist, or cost too much.Fortunately, this situation has changed very rapidly in the past year andthe equipment will continue to become more affordable and more readilyavailable for use, not only in university settings, but in public school settings as well. The equipment used inthis study is merely representative of the various types of technologiesavailable today, and does not represent a 'must-have' listing, but ratherrepresents a mid-level range of both software and hardware which is available for use.

Video Camera

A Sony Super-8 video camera with anadditional steady-cam feature was used in this study. It is recommendedthat the camera have the steady-cam feature, especially for use in physicaleducation settings, as this will enable the camera operator to better capture the motion sequences which are common inteaching physical education skills. This camera also includes an RCA outvideo port which allows the camera to be connected directly to thecomputer. Some more expensive digital cameras may also include FireWire capabilities as well as an S-Video port, which will allow for even better videotransfer from the video camera to the computer. Another useful piece ofequipment, and one that many video camera users fail to purchase, is atripod. The tripod will allow for steadier video shots and will allow the camera operator to more easily followaction shots, while maintaining a steady picture for later use.

Computer and video capture/digitizing board

The computer used in this study was an AppleMacintosh G3/300 with an internal video/multimedia board, with both RCA andS-Video input/output ports. The memory on the computer had been upgradedto 96 MB of RAM; it would be prudent to equip the computer with as much RAM as possible (or affordable). Theadditional amount of RAM is often needed for both video digitizing as wellas editing of the digitized video. On the Windows equipment side, theDazzle Digital Video Creator plugs into the printer port of your computer. (Dazzle requires at least a 133MHzPentium, Windows 95/98 and 32MB of memory, although those are definitelyminimum requirements.)

CD-Recorder

The price and capabilities of CD-Recordershave changed rapidly in the past year. The cost has dropped significantlyand the recording speed has increased at least two-fold. Still, therecording time needed for creating a CD is not short and can vary greatly

depending upon the type of computer, amount ofmemory and type of information which is being placed on the CD. A morerecent issue is the use of a CD-Recorder (which allows you to master a CDone time with no changes) versus the use of a CD-ReWritable drive (which allows you to repeatedly rewrite yourCD-R media). You should look for at least a 4x write and a 12x read whenlooking for a CD-Recorder. The cost of CD-R media is fairly low, oftenless than $2.00 per blank disk, while the cost of CD-RW media ranges from $10.00 to $20.00 per blank disk.

Software

There were three types of software used forthis project: software used to digitize the video (in conjunction with thehardware), software to edit the software and prepare the video clips forinclusion on the final CD, and software used to create the final user interface program for the CD. The digitizingsoftware used for this project was the software which came with the AppleVideo Card. This software allows for basic video capture anddigitizing of video directly from the video camera and produces QuickTimevideos. We chose to use quarter-screen size videos for this product. Youcan, however, adjust the size of the QuickTime movie according to your need. Unfortunately, the digitizingsoftware does not allow for the level of editing needed to produceprofessional quality video. There are several good quality shareware basicediting programs available (including Popcorn and QuickEditor, both of which are very easy to use). Adobe Premieresoftware was used for the final video editing, which allows the user toinclude various transitions, text-based additions and manipulation ofmultiple video clips. An academic version of Adobe Premiere is available, which will reduce the cost of thispowerful yet very useful software to fit into a school budget.

There were several software options availablefor creating the final user interface. HyperCard and HyperStudio are bothvery popular and widely used software packages which allow for quickdevelopment of interactive programs. Director is widely used in the professional arena for the development ofCD-ROM-based instructional programs, but can be more difficult to learn anduse. The program used for the development of our physical education CD-ROMfor this study was MPower, which is very similar to HyperStudio in its ease of use (see Fig. 1). No programmingskills are required; much of the interface is point and click. Althoughnot as powerful as Director, MPower produces a very professional qualityproduct for those with limited time and/or programming skills. MPower is available for both Macintosh andWindows computers, and, like HyperStudio, comes with a player which allowsyour projects to be distributed to others on both platforms. (Note: Ifyou are used to HyperStudio, you will find MPower to be very similar. However, the final step in producingprojects which can be played by the player differs from HyperStudio. Thisis covered in the user manual, but can be easily overlooked if you aren'tcareful.)

Figure 1: Sample MPower-based Screen

Timeline

The timeline from initial decision to createa physical education CD-ROM to final mastering ran about twenty hours overa two month time period. Most of the time was spent in editing theforty-five minute videotape into usable video clips and developing the MPower program which presented the material. Aswith most instructional materials, the key is planning. Knowing whichvideo shots will best demonstrate the skill you are trying to showcase,being completely familiar with the software and hardware which you are using, having any extras (such as music oradditional graphics) ready when you are developing the final product, andhaving the complete text of any instructional material you wish to includein the final program ready BEFORE you begin final development, will reduce the amount of time needed todevelop a CD-ROM. As noted, most of the time for this project was spent inediting the actual videotape into suitable video clips. Many skills taughtin physical education consist of several small sequences which, when combined, form the whole. It takestime to isolate each skill so that it may be demonstrated as an individualvideo clip. (NOTE: When you are videotaping your skill, tape each skillseveral times and from different angles. Do not hesitate to videotape a skill ten or twenty times in orderthat you may get the BEST video clips for your final product.) Have a listof the skills you wish to use for the final product so that you may run achecklist as each skill is videotaped. We used both male and female athletes on our CD-ROM in order toreach a very broad audience of public school students. We also chose notto use any audio on the video incorporated into the final CD-ROM. Thiseliminated the need for voice-over and allowed us to videotape outside with traffic noises in the background. Theactual videotaping took approximately an hour to cover the six skills usedin softball. The amount of time needed for taping will vary depending uponthe type of skill you are demonstrating and the performance level/skill level required

for the finalproduct. The actual creation of the final product using the MPowersoftware required several hours, primarily during the initial selection ofthe 'look and feel' of the program and in the final testing of the product before the CD-ROMs were mastered. Fig. 2shows a typical screen shot from the final CD-ROM.

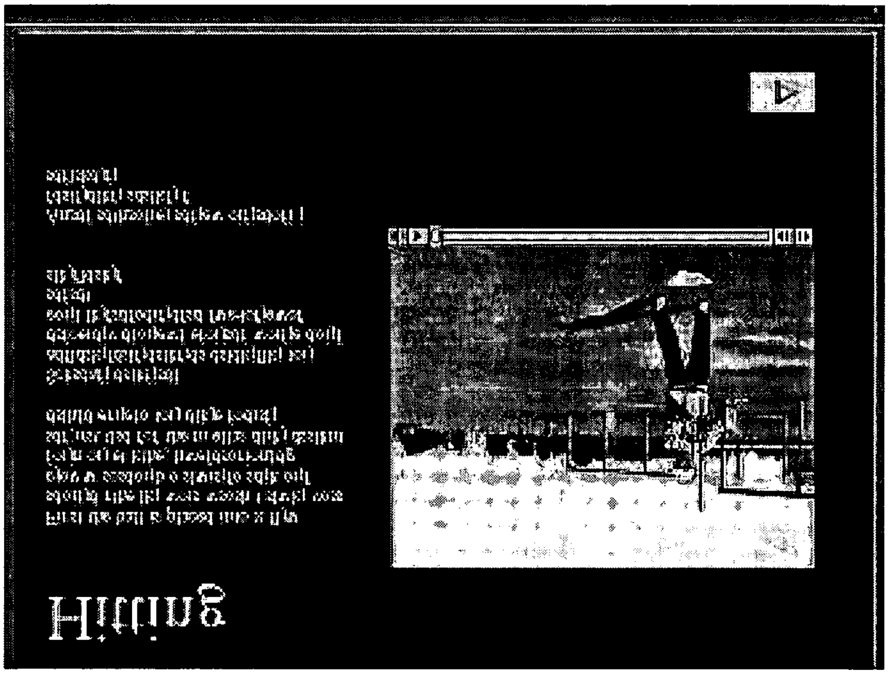

Figure 2: Sample Screen Shot

Steps

1. Select the skills which you wish todemonstrate on the CD-ROM.
2. Analyze those skills, breaking each skillinto its various elements.
3. Develop a list of the video which youwill need to display each skill element.
4. Write and edit the instructional textwhich will be used to describe each skill.
5. Videotape the skills. Tape each skillseveral times and from several different angles. If audio is used, beaware of any ambient sound which will occur on the videotape. Be aware oflighting conditions.
6. Allow ample time for the editing of thevideotape. One skill may consist of several shorter parts, each of whichwill need to be emphasized. Decide which size video will best display theskill being demonstrated, yet will allow users with older computers to utilize the program.
7. Using good instructional design techniques[1], create the interactive program which will be usedby the students. Avoid extraneous audio, flashiness, and text, but doinclude all information which will be needed by the student.

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[1] But that is another paper!

8. Test the program on several people atseveral ages and levels before mastering the final CD-ROM. Use thistesting as a way to fine-tune, edit, add, or remove information.
9. After final testing, allow ample time forthe actual mastering of each CD-ROM. Depending upon the amount and type ofinformation and your equipment, the creation of the actual CD can take from20 minutes to several hours.

The use of CD-ROM can greatly enhance theteaching of skills in the physical education class. The use of QuickTimemovies allows the student to study correct stance, positions, and set-upand follow-through. The ability of QuickTime movies to be played in still-frame, slow motion and reverse provides anadditional tool for teaching physical education skills. It can even be a learning experience for those developing the CD-ROM. It is truly a win-win situation.

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Using Multimedia to Document Case Studies in an Inclusive Classroom: An Adobe/SITE Partnership Project

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Abstract: Integrating media and technology use into statewide educational programs is a priority in the State of Oregon. The Graduate School of Education at Portland State University (PSU) is actively participating in this endeavor by providing preservice and inservice programs with increased emphasis on the integration of media and technology. As Oregon's only urban university, our mission addresses the importance of learning across the lifespan as a means of meeting our communities' educational needs.

Students in the Inclusion Program, which was started at PSU in the fall of 1994, participate in a collaborative program sponsored by the Curriculum and Instruction, and Special Education Departments. At the conclusion of their two-year pre-service program, students are able to be licensed as both elementary classroom, and special education teachers. During their final term, they have the opportunity to complete a Master's Degree, as well. One master's project option is to plan and produce a case study of a pupil or teacher in an inclusive school environment. Through this project, we are teaching students how to document their case studies with a combination of digital video, images and audio, and text. Students will then use multimedia authorware to create presentations which share their case studies.

This paper will discuss the progress of this project from the perspective of both faculty and student. It will also report on the value of the Adobe/SITE Partnership which is helping to make it happen.

At SITE'98, representatives of Adobe Software and the Society for Information Technology in Teacher Education (SITE) introduced a unique new collaboration. Participants were challenged to design project proposals which "...explore ways in which Adobe tools may support teacher education programs." This seemed like a perfect opportunity for students and faculty in our pre-service program to experiment with the creation of multimedia portfolios or case studies. As a starting point, we chose to focus on students in our Inclusion cohort, who would be developing case studies as part of their master's degree projects. A team of faculty which included Emily de la Cruz (Curriculum and Instruction (CI) faculty), David Bullock (CI faculty and Director of the Metropolitan Instructional Support Laboratory (MISL)), Jackie Temple (CI faculty and cohort co-leader), and Nancy Benson (Special Education (SPED) faculty and cohort co-leader) wrote and submitted a "curriculum-based" proposal which was selected as one of the partnership projects.

BACKGROUND

Within the Graduate School of Education (GSE) at Portland State University (PSU), we have a variety of programs including pre-service education for elementary and secondary classroom teachers, educational media, special education, counselor education, and administration. Our fifth year programs lead to licensure or endorsements in

the aforementioned areas. We also offer Master's and Doctoral Degree programs, as well professional development courses. As a part of Oregon University System, we have been challenged by the State of Oregon to develop both pre-service and in-service programs and experiences, which support PreK-12 schools in their "Education for the 21st Century" mission. Our own mission statement: *"The Graduate School of Education challenges itself and others to meet the lifelong educational needs of diverse urban communities."* reflects our commitment to this task. This project provides an opportunity for us to focus on the issues of technology in education (specifically inclusive education) in a new and creative way, and extend the benefits of that experience to the various communities we serve.

One of the goals of our teacher education program is to identify ways in which students can authentically engage in activities using technology in their roles as students, prospective teachers, and practicing professionals. Following Hansen's (1993) model for technology in the teacher education curriculum, we have based our program on three elements: (1) purpose (experiential learning, personal development, technological enlightenment); (2) content (professional knowledge, curriculum development competence, pedagogical knowledge and skill, technological foundations); and (3) process (planned reflection, classroom instruction, individualized and group learning, technological method).

The Inclusion cohort is a group of students in a pre-service program working toward a dual-license in elementary education and special education. "This program reflects the rapidly changing nature of America's schools, where students with disabilities are being integrated into regular classrooms with increasing frequency, thereby necessitating all school personnel to have a broader professional preparation in working with diverse populations (GSE, 1998)." The program requires a two-year commitment, and includes coursework and student teaching in both areas. It emphasizes the benefits and challenges of teaching special education students in an inclusive environment, and provides students with modeling from teachers who are doing this successfully. At the conclusion of their two-year program, students are able to be licensed as both elementary classroom, and special education teachers. During the last term of their program, students complete their Master's degree. One option is to create a case study of a teacher in a classroom or school which practices inclusion.

Using case studies in teacher education is a proven method for helping students examine and reflect on teaching and learning practices (LaFrambouse & Griffith, 1997). Well chosen case studies can help instructors illustrate the concepts they are teaching by providing authentic examples from experienced professionals (Cranston-Gingras, 1997), and provide students with "real world" models which can be examined from various perspectives (Glomb, 1997). Case studies which focus on teachers who practice inclusion are not very prevalent, however. In addition, a search of the ERIC database found only one document which dealt with the use of multimedia case studies in teacher education (Mazur & Bliss, 1996), but it does not deal with inclusive education. One alternative, in the absence of such material, is to have students create their own case studies and share them with their colleagues. Moving these case studies into a multimedia format also provides the authors with an opportunity to learn and model effective use of multimedia, while providing a valuable resource for our teacher education program.

PROPOSAL

Our goal, through this project, is to help students create multimedia versions of their case studies. In doing so they will learn how to use multimedia for their own teaching and learning, develop models for other pre-service students, and add unique "documents" to the body of knowledge about inclusive education.

In our proposal we stated:

> "Through this project, we plan to teach current students who choose a case study project how to document their case studies with a combination of digital video, images and audio, and text. Students will then use multimedia authorware to create presentations which share their case studies. We plan to share these multimedia projects with other cohorts in the Graduate Teacher Education and Special Education programs, and will use them as models for future case study and portfolio projects."

We outlined three four steps in the process of preparing students, and assisting them as they complete their projects:

- recruit and train mentors to work with students and faculty during Summer Term 1998;
- develop and conduct workshops for students and faculty during Fall 1998 and Winter 1999 terms;
- help mentors and faculty develop demonstration projects during Winter Term 1999; and
- assist students as they develop their own projects during Spring Term 1999.

Presentations and student perceptions will be evaluated at the end of the project. We will also survey faculty and student mentors to determine how best to extend the mentoring experience beyond this project.

PROJECT

As with many good plans, the realities of time and people commitments have resulted in several major adjustments to our plan. The first challenge came with the selection of student mentors. Due to the rigorous nature of this cohort's program, Inclusion students found it difficult to make the time commitment necessary to work in the program and be a mentor/graduate assistant with this project. Fortunately, the program received an Eisenhower Grant which helped provide the financial assistance that an assistantship would bring. For that reason, David Gilde, a student in our Educational Media Program was selected as a graduate assistant to work with this project. He began work in the fall of 1998, after completing the Graduate Teacher Education Program (GTEP) in the GSE during the 1997-98 school year.

Having more than one mentor seemed important to the success of this project as well as other faculty work in the GSE, so mentoring has become part of the "job description" of all MISL Graduate Assistants. This program provides support for the Adobe/SITE project, as well as support to faculty throughout our school. Due to the overwhelmingly positive response from faculty and staff, Phyllis Edmundson, our new Dean, provided funding for two additional assistants.

As part of his assistantship, David Gilde has worked with David Bullock to develop the Adobe software workshops that Inclusion cohort students need. These workshops will be field tested with students in a course titled "Computer Applications in Instruction" during Winter Term 1999. Thanks, in part, to the Adobe/SITE partnership agreement, students participating in these workshops will learn to use software such as Adobe Photoshop or PhotoDeluxe, Adobe Premiere, Adobe PageMill, Adobe Illustrator and Hyperstudio. This agreement allows the GSE to purchase 25 copies of any Adobe title for $325 (or $15 each). Software is available to students in the Metropolitan Instructional Support Laboratory (MISL), the instructional support laboratory for the GSE. Students also have access to camcorders, digital cameras, scanners, and laptop computers through the MISL. Instruction on the use of software and hardware is a part of the Instruction and Technology course that this particular Inclusion cohort completed in the fall of 1997. Since the software for this project was purchased after that course, the new workshops will be critical to the success of the case study project.

The workshops we have designed are relatively task-specific, without superfluous information about the very advanced capabilities of the software that is beyond the interest and needs of students. These applications are covered in the workshops:

ADOBE PHOTODELUXE

This user-friendly, mini-Photoshop (below) will be used for basic processing of scanned or imported images. Topics include:

- Basic scanning techniques
- File format basics
- Inserting images into web documents
- Basic image manipulation (cropping, sizing, orientation)

- Basic special effects

ADOBE PHOTOSHOP

Instruction with this advanced digital photo processing application will focus of specialized graphics manipulation. Topics include:

- Working with layers and masks to make photo collages and combine images
- Creating web page components such as buttons and banners
- File size and resolution considerations
- Combining images and text in graphics
- Using filters and transformations for special effects
- Creating thumbnail images for web page

ADOBE PREMIERE

Students will learn how to capture video from an analog VHS cassette and digitize it for processing in Premiere. Topics include:

- Basic video capture
- Importing clips
- Timeline basics (assembling clips, editing)
- Recording and adding soundtracks to timeline
- Basic special effects (fades, etc.)
- Length/file size considerations

ADOBE PAGEMILL

Students will learn to create web pages which combine digital images and video appropriately with text. An emphasis will be placed on using a web design which enhances the effective delivery of the case study material. Topics include:

- Creating a basic web page
- Adding graphics and video
- Setting up hyperlinks
- Effective web design
- Hot spots and other advanced techniques

These workshops will be challenging, but the focus will remain on the students' task at hand, which is creating interesting multimedia presentations/web pages, not becoming software experts.

Students in the Inclusion Cohort will be completing their second term of full-time student teaching during Winter Term 1999. For that reason, it will be difficult to involve them in a regular series of workshops. During this same time, several students from the Inclusion cohort and other programs will be given the opportunity to create model case studies which will be used with the full cohort.

During Spring Term 1999 Jackie Temple, Nancy Benson, and other Special Education faculty will teach students how to create case studies, and provide students with opportunities to observe and study exemplary teachers. By that time, the workshops that David Gilde has developed will be evaluated and revised (if necessary), and ready for use with students in the Inclusion Cohort. Faculty working with the project will have had two terms of mentoring, and demonstration projects will have been developed. Cohort leaders decided to make the multimedia aspect of the case studies optional, so it isn't yet known how many of the Inclusion cohort students will choose this option. We plan to share examples of their finished products, as well as a final report on this project at the SITE 2000 conference.

CONCLUSION

The newly acquired Adobe software has been a benefit to many people. The MISL is open to all GSE and PSU students throughout the campus. Students in the GTEP and Special Education programs have used it as they create community study projects and work samples. Students in continuing education courses have used the software to help create web pages and portfolios. Faculty have used it as they create class and conference presentations. Graduate Assistants/Mentors have developed workshops, and worked with individuals as they learn how to take advantage of the potential this software offers.

Our involvement in this project has sparked interest in multimedia development from many GSE faculty and students. The workshops developed for this project will be refined and presented throughout the school. As the university challenges faculty to develop their own portfolios, and faculty challenge their students to do the same, we expect to see more opportunity to use this software in creative ways. Examples of those projects may also be a part of a SITE 2000 presentation.

When we first proposed this project, we hoped to have more examples of the finished product than we do. Unfortunately, that expectation was unrealistic. What we do have, at this point, is the framework for two very important projects: the multimedia case study project, and the faculty mentoring project. We also have a series of software workshops which will be used with many different audiences, and extended to faculty and students throughout our programs. This project has helped faculty and students see the possibilities that multimedia presentations and software provide. The benefits extend throughout the Graduate School of Education and Portland State University to the schools with which our graduates work, and the children they help to educate. We are very thankful for the opportunity this partnership has helped provide.

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Using Technology Effectively in the K-6 Classroom: Professional Development for Teachers

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Abstract: There are many sources of professional development for K-6 teachers that help them learn how to use computers, but much less is available on how to use computers in classrooms to enhance learning. Members of the Department of Science and Mathematics Education at the University of Melbourne, Australia, have developed a resource for that purpose. Included are 36 Professional Development modules and 30 associated Case Studies illustrating how computers can be used to enhance learning. This project involved teachers and academics involved in teacher education from Australia and the USA and has resulted in a powerful resource to support K-6 teachers in integrating computers into their classrooms.

Introduction

CLICK!: Computers and Learning In Classrooms: K-6 is a professional development resource for teachers about effective uses of computers in the K-6 classroom. It was developed by members of the Department of Science and Mathematics Education (DSME) at the University of Melbourne, Australia. The Department of Science and Mathematics Education teaches subjects in computer education and has considerable experience in offering professional development (PD) for teachers. There was a need to develop a professional development resource for K-6 teachers to enhance teaching and learning in classrooms as, although there is plentiful PD for teachers about *using computers*, there is a much more limited offering of PD in *using computers effectively to enhance teaching and learning.*

A key to the development of the resource was consultation with many classroom teachers and principals. At each stage of planning and development an expert group of teachers and principals from K-6 schools advised on the content, form, and look of the resource. In addition, academics (teacher educators) and teachers from Australia and the USA contributed to the resource. In total, almost a hundred academics and teachers contributed. The project was undertaken over 18 months, starting mid-1997 and completed in late 1998.

What is *CLICK!* ?

CLICK! comprises 36 professional development modules, 30 case studies about the effective use of technology in K-6 classrooms, and over an hour of video and multimedia resources. The Professional Development modules on *CLICK!* address issues related to using technology effectively in the K-6 classroom. The Case Studies describe how K-6 teachers are using technology to enhance the teaching and learning processes in their classrooms. Most Case Studies include examples of children's work, both paper-based and electronic. Videoclips show interviews with teachers addressing issues raised in the PD modules and Case Studies, and classroom situations where technology is being used effectively. In addition there are three *Virtual Classrooms* which are a virtual reality environment (using QuickTime VR) that

enables a viewer to 'look around' the classroom, seeing what children are doing, catching a little of their discussion and observing how the computers in the classroom are being used for curriculum purposes.
In brief, *CLICK!* comprises:

- 36 Professional Development modules
- 30 Case Studies
- 3 Virtual Classrooms
- an hour of video clips

Professional Development Modules

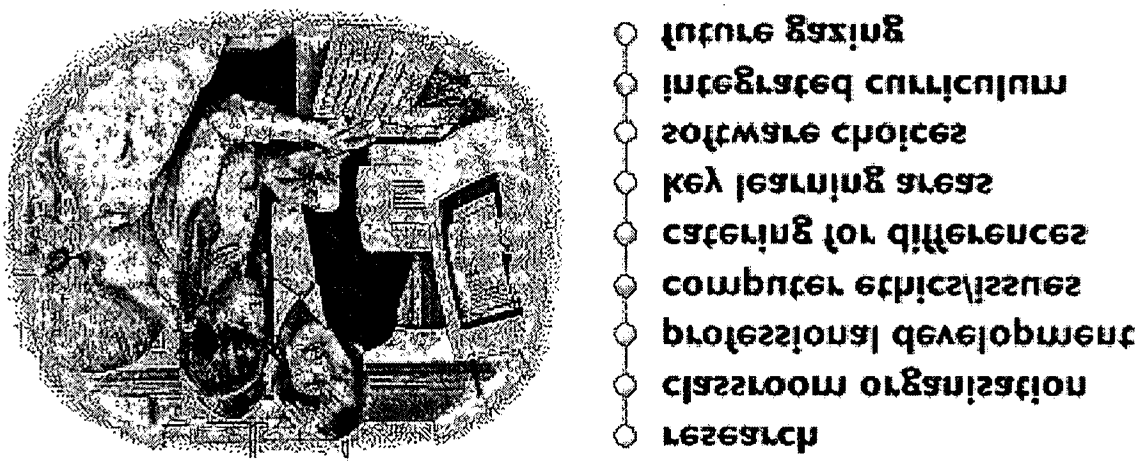


Figure 1: Areas of Professional Development modules offered on CLICK!

The Professional Development (PD) Modules cover a range of topics within nine broad areas (Fig. 1), with a number of PD modules within each of these areas (Fig. 2). For each Professional Development module there is text of the module (which is also available in portable document format [PDF] for printing), a PowerPoint presentation of the PD module to support a teacher deliver professional development to their colleagues (also available in PDF), and each Professional Development module is hyperlinked to relevant Case Studies and video clips.

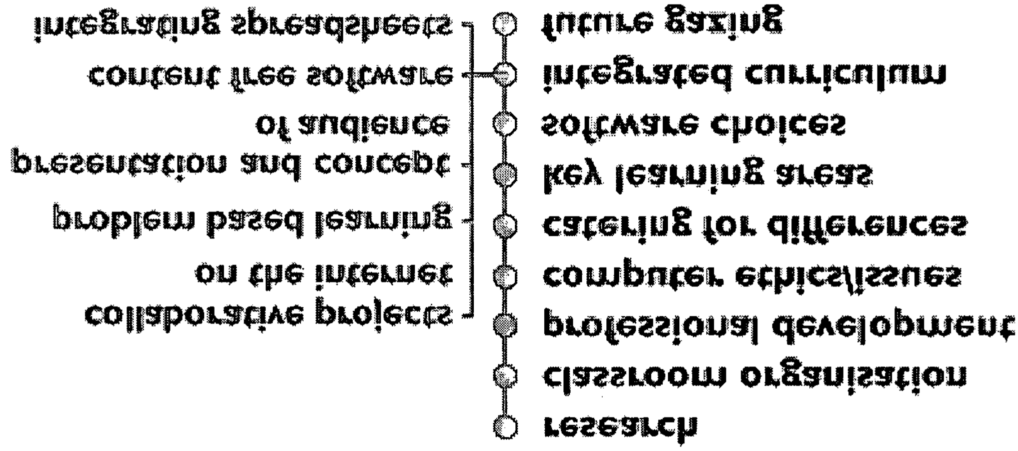


Figure 2: Professional Development modules in the 'Integrated Curriculum' area.

Case Studies

There are 30 Case Studies which have been prepared by practising teachers. The Case Studies cover all major curriculum areas and levels (junior, middle and senior) of K-6 schools. The 'units' described in the Case Studies range from a single lesson to a term long unit. Sections of each Case Study include the curriculum focus of the unit, the teacher's planning for the unit (including lesson plans), the teacher's reflection on the unit, hyperlinks to related Professional Development Modules and related video clips and examples of children's work (Fig. 3).

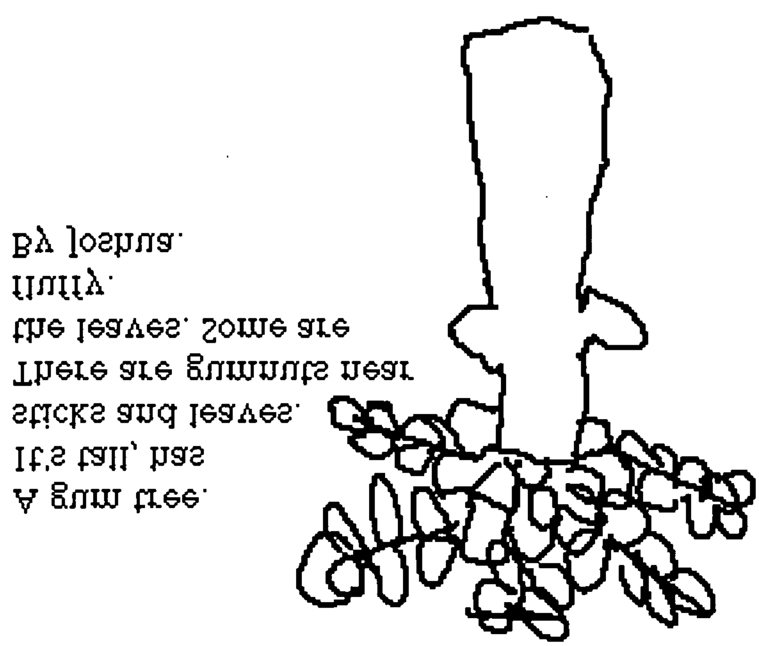


Figure 3: An example of a child's work using an eMate computer on a field trip to the Botanic Gardens (from the 'Life and Living' Case Study).

Video

There is almost an hour of video on the CD-ROM including the *Virtual Classroom* (as described below), video provided by the 'Apple Classrooms of Tomorrow' project and video from the 'Technology In Learning and Teaching' (TILT) series developed by the New South Wales' Department of School Education.

In each of the three *Virtual Classrooms* the user can explore the classroom using QuickTime VR (virtual reality) technology. The user can look around the classroom from a central location and zoom into areas of interest and click on aspects of the image of interest to see a video clip of what is happening. Video taken in these classrooms shows exemplary use of technology and illustrates aspects of classroom management that facilitate effective uses of the technology to enhance learning. The three teachers from these classrooms discuss how different models (two computer classroom, computer laboratory, and a mixed model combining both computers in the classroom and a computer laboratory) work for them and the strengths of each model and classroom management techniques that make them work well.

The *CLICK!* Model

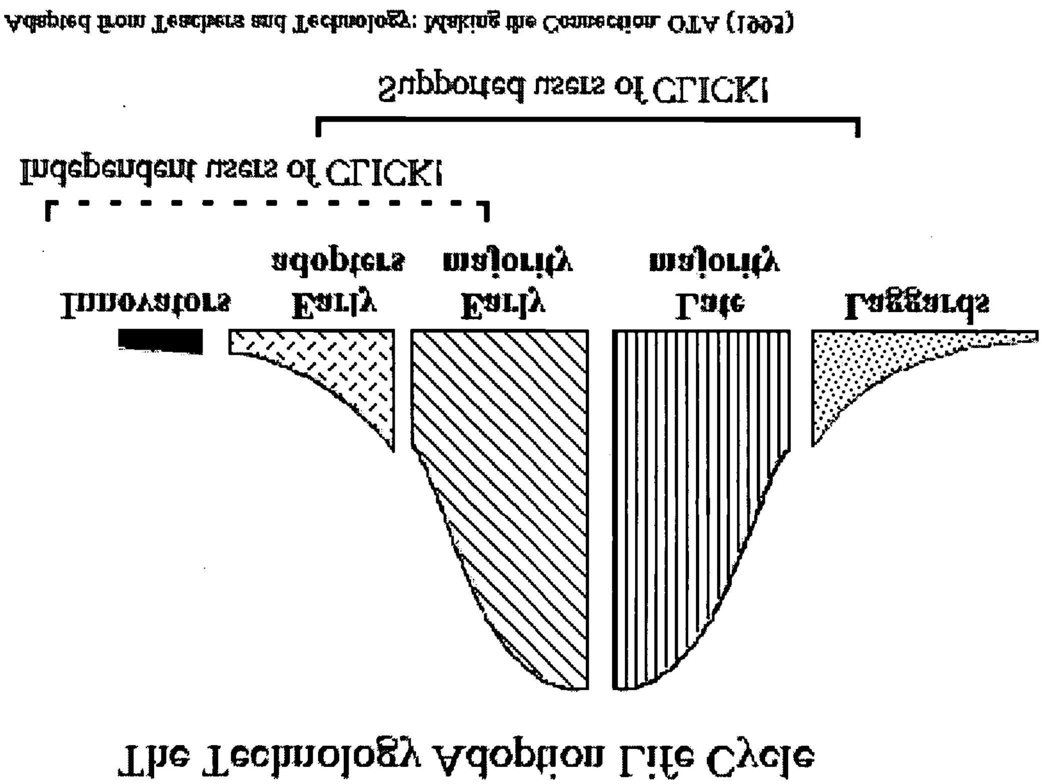
Based on the university's extensive experience with teacher training and professional development and the expertise of the consultancy group of teachers and principals, we were confident to assume that:

- Some teachers know about using technology in the classroom;
- Most teachers want to know about using technology in the classroom;
- Teachers learn well from other teachers in their own school environment.

In this situation, and given the magnitude of the problem of skilling the teaching workforce to use technology for curriculum goals, it seemed most valuable to provide a resource that could be used individually but also facilitated school-based professional development. Site-based, peer-assisted professional development that is supportive of a clearly articulated vision for children has been found likely to raise student achievement (Rényi, 1996). That this 'train the trainer' model is effective has also been found in Australia for professional development involving information technology (Smart, 1996). *CLICK!* therefore aims to support professional development which is presented by a colleague in the school environment and which is focussed on enhancing student learning. It can be used individually, but it specifically aims to support 'technology leaders' who, after expanding their own knowledge of an area using *CLICK!*, will provide professional development for their colleagues.

1☐ Using the language of *Teachers and Technology: Making the Connection* (OTA, 1995) these technology leaders are the innovators or early adopters (Fig. 4), while most teachers fall into the early majority and late-majority groupings. It is envisaged that in the first instance *CLICK!* will be used by technology leaders to strengthen their own knowledge and to support them in delivering professional development to their colleagues. The PowerPoint presentations and the associated print materials can be used as they are or easily modified. Further use of *CLICK!* by some teachers in the majority groups is envisaged to follow up what has been learnt by exploring the Case Studies and perhaps undertaking related Professional Development modules by themselves.

1☐



1□

1□ **Figure 4:** The Technology Adoption Life Cycle showing where users of *CLICK!* would fit in this life cycle.

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Conclusions

There is ever-increasing pressure for teachers to include technology in their classrooms. Most current teachers completed their formal education before computers were a standard part of the classroom experience and thus many teachers are uncertain about using technology in their teaching. Other teachers, however, have grasped the potential that technology offers for enhancing learning. They use technology extensively both in their lives and their classrooms. For another large group of teachers the mechanics of using computer technology remains a barrier. These three groups of teachers have different needs and will play different roles in transforming education.

There are many resources and professional development sessions offered to teachers about how a particular piece of software or hardware is used. This is a major need as teachers who do not feel comfortable with a tool are unlikely to use it in their classroom or to use it well. However, considerably less is available on using technology effectively in the classroom to enhance children's learning and this is what *CLICK!* addresses.

Feedback from teachers thus far is that there is a real need for a resource such as this. Teachers particularly like the balance between the Professional Development modules, where background information and research findings are presented, and the Case Studies, where classroom teachers describe and reflect upon

how they have successfully used technology to enhance learning in their classroom. The inclusion of lesson plans and electronic examples of children's work enrich these Case Studies in a way that is not possible in a textbook. Another feature strongly praised by teachers is the material provided that support teachers in presenting professional development sessions to their colleagues. The inclusion of PowerPoint presentations for each Professional Development module and printable versions of all Professional Development modules and Case Studies make the resource easy for the Professional Development coordinator to use to share knowledge through a school. The major strengths of the resource reflect those features that the teachers in the development group defined as important to them, which reinforces the practice of having members of the target audience as part of the development team for a project such as this.
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New tools for new thoughts: Effects of changing the "Tools-to-Think-With" on the elementary mathematics methods course.

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Abstract: A central tenet of mathematics education reform is the integral role of technology at all grade levels. The current technological changes combined with the changes in the mathematics content and instructional method require elementary mathematics teachers to be able to design technology intensive lessons for exploration and discovery of these concepts through appropriate computer applications. In actual practice, however, most computer applications provided for mathematics education consist of software designed for a specific educational purpose - the solution in a can scenario. Furthermore, economical constraints often stand in the way of incorporating such special purpose software into an instructional setting. In this paper we will discuss an alternative to this traditional approach which shifts the instructional focus specific computer applications to more sophisticated uses of general purpose software. In particular educational uses of spreadsheets will be developed as an exemplar for this approach.

Introduction

Frequently, when we talk computer applications as pedagogical tools in the mathematics classroom we mean software designed for a particular educational purpose. Yet economical constraints often stand in the way of incorporating special purpose software into an instructional setting and thus challenge computer-mediated mathematics pedagogy and ongoing inservice and preservice programs. A possible way to address the financial challenge is to shift emphasis from specific computer applications as teaching and learning tools to a broader and more sophisticated use of general-purpose software. Spreadsheets, for example, seem to become more and more available in schools, colleges, and universities.

How can the retrofitting of generic tools into an educational environment (Kaput 1992), particularly the introduction of spreadsheets into elementary mathematics classroom, be achieved? What does it take for mathematics teachers to develop into technologically minded cognizing and reflective agents (Cooney 1994), capable of appreciating the field of technology-mediated mathematics education as disciplined inquiry, and skillful in incorporating spreadsheets into the practice of mathematics teaching?

Background

Traditional mathematics instruction has emphasized procedures, memorizing algorithms, and finding the "one right answer". Mathematics, as it was most often presented, was not a subject open for discussion, debate, or creative thinking, nor were students encouraged to find alternative ways to solve a problem or different procedures for carrying out an operation. Computational expertise resulted from this, but little else. Students followed the algorithms necessary to solve a problem, but could not understand why or how those algorithms answer the question at hand. Given this, it was hardly surprising that students became imbued with rigid mental representations of mathematical problems.

This is unfortunate since flexibility appears to be a characteristic valued in many domains. Researchers from many fields associate the flexible application of rules and strategies with expertise and higher levels of cognitive operations. Indeed, one key to successful learning in this newer approach to mathematics instruction is flexibility in choosing and using mental representations.

At this point a dilemma develops. While we now know a great deal about the current internal representations of people engaged in a variety of tasks, we know far less about how they arrived at those representations. In short, while we know a fair amount about what it means to *be* a mathematician, we still don't know very much about how to *become* a mathematician. If we want to achieve the goals of the NCTM Standards, it is necessary to first understand how one arrives at those goals.

Finding that competent mathematicians score well on tests of computation, for example, does not mean that we should attempt to implement a mathematics program emphasizing the basic facts. Rather we must closely examine how competent mathematicians reached that end state. A constructivist approach toward learning has been widely suggested as a way to explain how people acquire new information. In this perspective, learners create their own internal representations of the external world. This view has been widely embraced by the mathematics community, but as many have pointed out constructivism is a loosely construed concept.

Perhaps one of the more telling problems with branches of constructivism that adheres too closely to a representational perspective is that it leads to several problems. First, it falls into the learning paradox. If learning is triggered by internal representations, how does one construct internal mental representations of objects which are more complex than those which already exist in one's mind? Second, since the goal of instruction in representational positions is to provide explicit and transparent representations of mathematical relationships, when instruction fails the teacher's only recourse is to provide more and more explicit and transparent representations. This inevitably leads to its own form of reductionism that strips mathematics relationships of their meaning.

The difficulties that representational positions have in offering an adequate description of learning, illustrate that descriptions of how one learns may be far more complex than descriptions of existing mental representations. It appears that representational views of learning may, with different wording, lead back to the same problems with mathematics education discussed above. We are still left with some basic foundational questions concerning how children learn and how can we describe that learning.

We are not critiquing constructivism to distance ourselves from constructivism, but to clarify directions that offer more, and less, potential for constructivist educators to pursue. As pointed out above, constructivism is a broad umbrella under which many theoretical positions have pitched their tents, and some of those positions lead to contradictions between views of knowledge and an active learner.

Our position is similar to that of Cobb, Jaworski, & Presmeg (1996) when they describe an approach that views mathematics as both an individual and a collective activity that transcends the representational view. This view is shared in Schoenfeld (1992) who has approached the individual and the collective by suggesting that people learn mathematics by becoming apprentices in a mathematics culture. Participants in a mathematics culture view themselves as practitioner of mathematical sensemaking. He goes on to argue that one does not need to know all of the basics before one begins to think like a mathematician. It is necessary, however, that students must grapple with real problems, not routine exercises in which the territory is already mapped out. In "real problems", as opposed to routine problems, the routines, methods, and procedures one should use to resolve the problem are not clear. Instead, one must actively work through the parts of the problem to arrive at a reasonable solution.

Prior research (Connell and Bounieav 1997) suggests that, for the case of mathematics, a focus upon action allows for the formation of a natural bridge between current constructivists in mathematics education and sociocultural researchers. Since sociocultural researchers have been influenced by *Activity Theory*, as explicated by Leontiev (1981) and other students of Vygotsky, it was probably inevitable that

mathematics educators and sociocultural researchers would begin making connections. Most sociocultural researchers avoid theories of learning which employ a metaphor separating the mind from what is to be learned. Instead, the concern is with combining the external world with the internal world of the mind. In these approaches to learning, the Cartesian distinction between the mind and the environment is replaced with an Einsteinian view of ongoing negotiated relationships.

In a sociocultural approach, learning is a result of active participation in a culture and is co-constructed by active interactions between the learner and her culture. From this, it might be inferred that if one wants students to think like mathematicians, than one must create an active participatory mathematics community. In turn, participation in this community will develop the skills associated with experts in the mathematics community (Connell, Peck, Buxton and Kilburn 1994).

The specific approach in this paper viewed individual mental functioning inherently situated in a social context and mediated by tools and signs. Many of the ideas presented in this paper have been included to great benefit in the respective mathematics education courses for preservice and inservice elementary teachers offered by the authors. As we will later report, these ideas affected the teachers' attitudes towards technology and challenged them to extend the use of spreadsheets to other elementary mathematics topics and to incorporate the ideas in their own teaching.

Outline of the computer-mediated setting

The sociocultural approach to mind views humans as coming into contact with the learning environment through the action in which they engage. In turn, the action employs different tools and signs called mediational means. The major claim of the approach is that the mediational means shape human action in many essential ways. Thus the term *mediated action* reflects the fundamental relationship between the action and mediational means which it employs. Any mental action directed towards solving a mathematical problem and mediated by appropriate tools and signs may be termed as *mediated mathematical action*. It is this action that is the focus of the paper.

Another basic principle associated with the approach is that human mental functioning, particularly mathematical action, originates in the course of communication and thus is inherently social. In a particular sociocultural setting, a contemporary elementary mathematics classroom, a mediated mathematical action can be grounded in the appropriation of the tools of technology such as computers and semiotic devices such as mathematical symbols and notation systems of the software used. The goal of an instructional discourse in such a setting is to use the mediational means as generators of meaning that, in turn, shapes mathematical action. From the sociocultural perspective "Ia]ny true understanding is dialogic in nature" (Voloshinov, cited in Wertsch, 1991, p.54), and this claim ties meaning closely to the dialogic orientation of the discourse. As far as an introduction of a computer into the discourse is concerned, it is of paramount importance to provide an environment capable of engaging the student into a purposeful dialogic encounter with the computer. The didactic emphasis of such an environment is to prevent undesirable consequences of authoritative discourse and to allow for the so called internally persuasive discourse that awakens new meaning for a student (Wertsch, 1991).

Description of implementation and instructor observations

The methods and approaches described in this article were presented by one of us (Abramovich) to 7 graduate and 5 undergraduate students enrolled in a continuing education course *Microcomputers in Elementary Mathematics Classroom.* The students, mathematics education majors, ranged from preservice teachers to experienced inservice teachers. Familiarity with Excel, however, was not a prerequisite of the course and, as it turned out, only one participant of the course, a practicing teacher, was familiar with the software. The instructor's use of a computer, an overhead projection panel, and a screen made it possible at the beginning of the course to introduce the teachers to a spreadsheet and give basic directions how to format the cells, use colors, and enter numbers and formulas into the cells.

Yet, learning to retrofit a spreadsheet into elementary school mathematics discourse was backed up mostly by the teachers' excitement about its potential as mathematical/pedagogical tool. A practicing teacher who had begun the course with only basic word-processing skills affirmed that a limited computer

background *"has not diminished my excitement and enthusiasm of the potential use of technology in my classroom."*

In her opinion, using technology in teaching mathematics to children *...parallels the development of mathematics itself over the centuries. From manipulative, to pencil and paper abstract notations, to using these notations (formulas) to generate information on the computer, I believe the children need multiple experiences to understand these complex relationships."* Looking forward to teaching mathematics with spreadsheets, she acknowledged: "I *am especially excited that my school is purchasing a portable large screen which I can use in the classroom for demonstration purposes. Even though the students will not be at computers themselves they can come up and shade in the squares tonswer the questions. My kids really like this.*

It should be noted that all information regarding spreadsheet specifics as well as mathematical demonstrations were introduced to the teachers not as a final product, but in a real time. This allowed for their active involvement in a discourse on syntax, content and pedagogy of the environment in keeping with the sociocultural emphasis of the intervention. The focus was for participants of the course to experience teaching with technology through multivocal egalitarian conversation about the birth, development and implementation of the ideas. In our opinion, it is this intellectual milieu that allowed an inservice teacher to remark: *I enjoyed our class discussions on the formulas, as we were able to try out and see the results immediately."* Indeed, although the classroom where the course was conducted had only one computer for demonstration purposes, the machine was available for those teachers who wanted to try their own ideas in front of the class. Another inservice teacher affirmed that *... if computers were available for individual or small group explorations I would have learned so much more.* This comment challenges the technological support of the teacher education course and suggests that the teacher has recognized the potential of computers as productive tools conducive to mediate mathematics learning. In addition, the particular emphasis on the amount of information learned by the teacher implicitly indicates the fundamental relationship between mathematical action and mediational means which, in the case of computer spreadsheets, turn out to shape this action in essential ways.

A survey conducted at the end of the course showed that among many topics taught in the course, the topic on exploring the concept of percent on a spreadsheet template had a major impact on the participants. In the words of one practicing teacher: *Most likely the whole class was impressed with using the grid to study percents. The reason is that this topic is taught to students in elementary school currently for the IGAP [Illinois Goal Assessment Program] state standardized tests."* This is of significant interest in light of "privileging" within a set of studied topics. This directly addresses notions such as how specific representations become accepted within the broader culture and come to have value. It also points to the manner in which the teachers arranged the topics in accordance with a hierarchy based on the power of applicability (Wertsch 1991 p.24) to a particular sociocultural setting -- elementary mathematics classroom.

One of the major advantages technology brings to the classroom was the emergence of an open ended intellectual milieu allowing for a variety of ideas to be explored. In such a setting, a teacher's role becomes one of extreme complexity for she or he is simultaneously substituted by a computer as an external authority for validation of truth and required to he an adaptive and reflective partner in advancement, capable of surviving ambiguity in a meaning-generative dynamic environment. Thus teachers' attitudes towards the so structured didactic setting may provide an additional insight into one's conceptualization of new patterns of interaction between content and pedagogy in developing contemporary mathematics teacher education programs.

For example, one inservice teacher expressed the belief that *"open ended pedagogy is an essential component in a mathematics classroom. Many times a child will pick up on things no one has ever noticed because they are not as tied to viewing the world through the constraints which sometimes limits the views of a more educated person. It is always a joy to view the world through the eyes of a child! Our educational system often is a study of what mankind has learned in the past, and we, teachers, following the tradition try our best to organize and present this body of knowledge to the next generation. Mathematics, however, is a dynamic discipline and must be presented to students as such. We must not restrict their young minds."*

This is in agreement with another inservice teacher opinion about patterns of interaction shaped by an egalitarian classroom discourse: *"Students can become interested and want to explore an avenue or branch of the assignment that the teacher may not have thought of before. Students may inherit enthusiasm not only from the teacher but other students. This [open ended[environment definitely allows for creativity."*

A particular example of such creativity was found in a collaborative work of two preservice teachers who demonstrated how rectangular grids could be employed for teaching routine topics in arithmetic. The cartoon displayed in Figure 6 shows an arithmetic task with "human sense" which, in particular, illustrates the fact that the origins of mediated agency can be found in social forms of human existence shaped by one's cultural background. All these examples definitely manifest the teachers' potential to be reflective and adaptive, capable of understanding how their students "come to know and believe what they do" (Cooney, 1994, p. 628). Better still, the teachers' own views on teaching and learning warrant their ability to harness semantic multivoicedness of technology-mediated discourse in future pedagogical orientations and decisions.

Note that assessment practices employed in technology-mediated settings can also be oriented toward developing teacher's ability to take intellectual risk in making pedagogical and/or curricula decisions. One such approach is to utilize the dialogic structure of classroom setting by encouraging preservice and inservice teachers to choose a topic for a project, formulate questions to be explored and decide on directions in which the ideas can be *extended.* Instead of mastering the process of making such decisions through experience in following them, the assessment of teachers' performance on computer-mediated mathematical assignments is organized along the lines of Palincsar and Brown's (1988) procedure of "reciprocal teaching" allowing them to "teach" the topic to the whole class,

Patterns of privileging found in the teachers' responses to question what did affect their choice of a topic for a final project provide yet a further insight into their belief system affected by experiencing first hand the power of spreadsheet-based technology. For example, one preservice teacher has recognized the potential of spreadsheets to reorganize the use of curricula materials: *"I wanted to use Excel in a way that provides students with more than problems from a textbook."* An inservice teacher had recognized how spreadsheets can be used in helping students make mathematical connections; *"Using a spreadsheet for the discussion of area and perimeter is a very powerful tool because it gives students the opportunity to think about and gain intuitive knowledge about factoring."*

Another inservice teacher described the role of spreadsheets in enabling students to gain a confidence as doers of mathematics. *A very powerful feature of Excel is the program's ability to give students the opportunity to work with problems that are very complex and not usually presented until a higher-grade level. Finding a solution to a very complex problem can raise a student's self esteem and motivation. Students may feel proud and excited about their accomplishments."*

These and other comments by the teachers favorably indicate their potential to move the field of mathematics education toward realizing the high visibility of the NCTM Standards. The authors believe that developing such ability in teachers is one of the fundamental goals of contemporary mathematics teacher education.

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A New Professionalism? Teacher Use of Multimedia Portable Computers with Internet Capability

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Abstract
This paper examines the experience of some of the teachers participating in the Multimedia Portables for Teachers Pilot. The Pilot was a major, highly successful project which put 1138 high-specification portable computers in the hands of practising teachers in a range of schools. As a member of the evaluation team, I was interested in the generally very high levels of motivation and self-reliance exhibited by teachers whom I interviewed in the course of undertaking case studies as part of the formal evaluation of the Pilot. The paper re-examines these case studies in the light of specific ideas of teacher professionalism and of the transition to postmodernity.

Introduction

There has been a sequence of initiatives to increase the use of computers in Britain's schools for over 25 years. In this paper I examine one particular phase of this extension of computers into the work of teachers and schools - the recent Multimedia Portables for Teachers Pilot. I will do so in the light of changing discourses of teacher professionalism, themselves set within the context of the transition to postmodernity.

I have taken the UK as the setting for these reflections. However, I am confident that, as predicted by Ennals et al. (1986), "whatever changes do come about in our schools as a result of the take-up of new technologies, the issues which are being opened up extend right across national frontiers; they are truly world-wide." The issues which I will bring to the foreground here are those relating to teacher professionalism and agency.

Modernist schools, postmodern society

The rise and proliferation of the computer is inextricably interwoven with the transition from the modern era to that of postmodernity. In particular, the development of increased computer memory and faster processing, together with the extension of the Internet, has been closely associated with the compression of time and space, a key characteristic of postmodern social, economic and cultural conditions.

Schools, it has been argued, are essentially modernist institutions (Hargreaves 1994), left as structural and procedural anachronisms whilst the world around them becomes increasingly postmodern in how it operates. Computers have made possible fundamental changes in how that world operates, but they have not (yet?) had the same impact on schools. Many aspects of the way schools are structured (subject departments, timetables, classrooms) mirror the characteristics of Fordist-type mass production, sometimes in the form of a malign, anti-professional 'neo-Fordism' (Hodgkinson 1997). Yet much of the economic activity of advanced economies has changed with the impact of new technologies. Though championed by some and accepted as inevitable by others, such change has not been without conflict, criticism and unwelcome, socially disruptive consequences. Can schools, indeed *should* schools, undergo the same transformation?

But schools do not suffer only from being 'out of synch' with such large-scale changes. Many modern societies are themselves in difficulty, economically and socially. And in such societies and their increasingly hard-to-afford systems of public education, schools are charged with the responsibility to "administer the innovative treatment if the ailing society is to recover."(Winer et al. 1987) Part of that 'innovative treatment' is to produce a flexible, highly qualified, technologically literate work force. "The aim of many policy-makers in the UK and around the world is to encourage evolution into a learning society for the next century: one in which all people

are responsible for their own learning throughout their lives. Access to information and learning will often depend on new technologies as well as on an approach to teaching which supports collaborative professional development. Governments in Europe and around the world have already recognised the need to review educational practices and incorporate new technologies. Their view is of a vocational imperative and one in which IT will increase the quality and efficiency of learning itself." (Somekh, B, and Davis, N, 1997)

Yet many of the schools charged with this responsibility have been slow to innovate when compared to the rate of technological change in business and industry. This is partly due to the inherent conservatism of the school as an institution, and also due to what has been termed 'innovation fatigue'. Educational policies and initiatives come thick and fast and, "... as the pressures of postmodernity are felt, the teacher's role expands to take on new problems and mandates - though little of the old role is cast aside to make room for the new changes. [Further,] innovations multiply as change accelerates, creating senses of overload among teachers and principals or headteachers responsible for implementing them. More and more changes are imposed and the timelines for their implementation are truncated." (Hargreaves 1994)

Computers into schools

The introduction and extension of the use of computers into teachers' work is one such innovation. Though without doubt change has taken place, the impact between and within schools has been uneven (see, for instance, Goldstein, G 1997). Watson (1997) has argued that one reason for this unevenness has been a "dichotomy of purpose", between a pedagogic, subject-focused rationale for the introduction and use of computers on the one hand, and a more vocational, technocentric rationale on the other. This has resulted in confusing messages to teachers, about the purpose of the adoption of computers in their work.

Since the early 1970's a sequence of initiatives can be identified (see Watson, 1997), linked by their underlying aim of increasing the use made of computers. Throughout this time, teachers have been exhorted to become computer-literate and to use IT in their work. However, at no stage has there been any financial incentive (eg tax breaks) for teachers to become computer owners (though some have, of course, bought computers for either or both family use and work-related use). So, in the absence of a personally-owned computer at home, many teachers have had their computer use restricted to what has been possible in school, with the additional possibility of taking a cumbersome desktop computer home for an evening, weekend or holiday.

The Multimedia Portables for Teachers Pilot (MPTP) 1996-7

The Multimedia Portables for Teachers Pilot, funded by the Government and managed by the then National Council for Educational Technology (NCET), can be seen in the context described above. The Pilot was one of 25 projects comprising the UK Education Departments' Superhighways Initiative, itself part of the preparation for the development of the UK's National Grid for Learning.

The aims of MPTP were "to:

- provide a varied group of teachers with personal computers that support multimedia and/or communications;
- increase teacher confidence and competence in the use of ICT resources;
- promote better learning in the pupils taught by the teachers taking part in the pilot." (DfEE et al, 1997, p.99)

In the summer of 1996 NCET issued 1138 high specification portable computers to pairs of teachers in 569 schools. The computers had full Internet capability, and access accounts with two Internet Service Providers were included. All but 8% of the portables had a CD ROM drive. All computers were issued with personal productivity software, together with a 'bundle' of educational CD ROMs. The teachers had successfully bid for inclusion in the Pilot, with the support of their headteachers. Headteachers' practical support was to be in the form of guaranteed in-school access to a telephone point for Internet access, together with the release of the teachers to attend an initial three-hour demonstration and training session. The teachers had given a brief outline of their proposed use of the computer and had agreed to record their use of the computer and to co-operate with the evaluation of the Pilot. Some of the teachers were starting from a very low base in terms of confidence and

competence in the use of IT, having had little or no prior experience of using IT either personally or in the classroom.

Teachers attended a three-hour start-up session during which the computer was set up, introductory training in its use was given and Internet access was demonstrated. In most cases this took place before the summer holidays, the intention being that the teachers could then take the computers home to further familiarise themselves during the holidays.

Beyond what I have already mentioned, few requirements or constraints were placed on teachers' use of 'their' computers. They could, quite literally, use them when, where and for whatever purpose they wished. There was no requirement to attend further training. The computers remained the property of MPTP, but were entrusted fully to the individual teachers who joined the project. At the end of the project, the computers would pass into the safe keeping of the schools involved, provided that they had been successfully used during the Pilot. The evaluation of the Pilot (Harrison et al. 1998) provided a detailed insight into the teachers' use of the computers and into the factors which were influential on this.

The Pilot was clearly successful in terms of its original aims, (so much so that the government has put in a further £23 million to provide portables for a further 10,000 teachers). Many teachers made significant progress with both their personal ICT capability and confidence during the life of the project, and their classroom use of new technology had increased correspondingly. This was consistent with the findings and recommendations of the Stevenson Report (Independent ICT in Schools Commission, 1997), that "ways should be found of making computers available to teachers to facilitate the learning process. Teachers rapidly become enthusiastic once they have regular hands-on access to computers. It could also potentially reduce some of the costly training hours required." (Section III, 4) "Where teachers have access to a computer of their own, they rapidly become competent and above all confident at using it. Any time spent at home with a computer is invaluable in staff development terms." (Section V, 4)

However, there is a danger in such cases to indulge in 'technological determinism'(see, for instance, Mackay, 1991), and to conclude that what happened, did so because of the computers. But this would give insufficient weight to the fact of human agency on the part of the teachers involved. One of the strongest predictors of success in the Pilot was teachers' attitude (Harrison et al. 1998, p29). I want to argue that this is indicative of the nature of their underlying professionalism. In order to understand fully the impact of the Pilot on the lives of the teachers involved, we should interpret their actions and use of the computers against a clearly articulated view of 'teacher professionalism'.

Forms of professionalism

Though the term 'professionalism' is often used, exactly what it means is neither universally agreed nor understood. At one level it may be taken as "something which defines and articulates the quality and character of people's actions" within an occupational group (Hargreaves and Goodson, 1996). In the opening section of this paper I briefly outlined some of the tensions between schools as modernist institutions, and their broader, postmodern settings in contemporary society. What does teacher professionalism look like in such a context?

Professionalism, in Sockett's view, is an amalgam of character, commitment, subject knowledge and pedagogical knowledge, but is not restricted to these essentially classroom-orientated attributes. There is also professionalism beyond the classroom, having to do with an orientation towards school and, beyond that, to public perceptions of, and debates about, education. "This wide role...is particularly important for a democratic society, for the teacher is a main purveyor of democratic civilisation." (Sockett 1993, p.8)

Of course, teacher professionalism is not an absolute. Ideas of teacher professionalism are socially constructed and complex. As Lawn (1996) says, "Teacher professionalism is not a fixed idea, it is situational and relational, it has contradictory aspects (progressive and conservative) and it is not homogeneous." (p120) Teacher professionalism, therefore, is also dynamic, and with the arrival of the market and the central specification of competences (including IT capability) a process occurs whereby the postmodern teacher begins to be

constructed. With more focus on outputs rather than inputs, competences become more important than 'education' and a different notion of professionalism begins to emerge.

Hargreaves and Goodson (1996 pp4-19) identify five forms of professionalism which correspond to different discourses around the contested notion of 'teacher professionalism'. The five forms are:

- classical professionalism,

(the longest-running discourse, rooted in an essentially modernist view), and four others:

- flexible professionalism;
- practical professionalism;
- extended professionalism;
- complex professionalism;

all of which "are emerging in the postmodern age" (*Ibid,* p.9).

Each of these, as indicated in the quotation from Lawn (above), is neither 'A Good Thing' nor 'A Bad Thing'. Rather, they are all inherently problematic, shot through with unrealised possibilities, hidden constraints and lurking dangers. As a recognition of these difficulties, Hargreaves and Goodson (1996) propose a model of "postmodern professionalism", based on seven principles which they identify as follows (condensed but with emphasis as in the original):

- opportunities and responsibility to exercise *discretionary judgement*;
- opportunities and expectations to engage with *moral and social purposes*;
- commitment to working collegially within *collaborative cultures*;
- occupational *heteronomy* rather than self-protective *autonomy*;
- a commitment to active *care* and not just anodyne *service* for students;
- a self-directed search and struggle for *continuous learning*;
- the creation and recognition of high task *complexity*.

These principles imply high levels of individual agency, that is, the power of the individual to do things and to effect change.

Postmodern professionalism? MPTP re-appraised

In this section I will examine the experiences of some of the teacher participants in the Pilot, in the light of the foregoing discussion of forms of professionalism, drawing on my own experiences as a member of the evaluation team.

Ingrid and Phil (fictitious names) teach at an inner-city primary school. I visited them on two occasions during the Pilot. Both were using their computers in a range of ways personally and professionally, and had been quick to integrate the computers into their teaching. Both showed a great deal of commitment to maximising their understanding of what the computer could do for them and put in a lot of their own time on this. Both had dealt with difficulties and overcome obstacles in the course of integrating the computers into their work, and both spoke animatedly when interviewed about their participation in the project.

Ingrid emphasised that she had a particularly strong commitment to developing positive attitudes to computers among girls. She had made virtually no personal use of computers before the Pilot, yet with the portable computer she quickly became an avid user of the Internet which she came to view as a "tremendous self-helping organisation". She identified "a time factor, but it's ever such fun!" and used the Internet at home to learn more in the evenings and at weekends (and doubled her 'phone bill). Ingrid quickly saw the possibilities of the computer for supporting collaborative research. She set up links via the Internet with teachers in Kentucky and Louisiana, and later, in Scandinavia. Though practically a neophyte on joining the Pilot, she soon went on to learn about file compression and zip drives, began downloading programs from the Internet and wrote her own homepage. She talked knowledgeably and confidently about all of these, using appropriate specialist terminology. She now held all her teaching plans on the computer. Her computer club used the portable to link with a school near Washington, USA, to whom they sent writing and pictures by e-mail. Ingrid herself felt ready to work more widely with other teachers in a support capacity. She also spoke enthusiastically about the

possibilities of telematics supporting the work of auditors (of whom she was one) in ensuring consistency under the national testing arrangements.

Phil started from a significantly higher base than Ingrid in terms of personal IT capability, but also made considerable progress. He was without his computer for several months due to a fault, but showed both patience and persistence in dealing with the problem, despite poor 'after-care' from the supplier. He learned to use spreadsheets to track reading scores and other assessment data by way of overlay graphs. He also used spreadsheets in his administrative role as Deputy Headteacher, to draw up rotas and timetables. Phil said, "As a professional tool, it's been brilliant." Phil foresaw the possibility of losing the computer from his personal use at the end of the Pilot. Even though he had bought a desk-top computer for home use four years previously, he felt that he would have to replace the portable at his own expense if it were taken from him. In his teaching he went to some trouble to take groups of children to the room in another building where the 'phone point for Internet access was located. This was so that they could use the portable computer to investigate a website as an additional information source in connection with a history topic, and also to use e-mail to communicate with a teacher from the school who had gone to the USA. He used the computer's multimedia capabilities to play 'music of the week' audio CDs in his classroom. Phil is actively interested in a proposed project for the school to develop a computer room which would be available for adult and community use in the evenings.

I have described these two cases at some length to give an idea of the extent of what these teachers did. These were not exceptional teachers in terms of the Pilot; rather they provide vivid examples of what can be achieved when teachers are given access to good resources and trusted to get on with the job. Others whom I visited did different things, but in most cases the levels of commitment and activity were comparable to Ingrid and Phil. Gillian and Julie (in different schools) both made a point of sharing the computer with colleagues. Gillian wished to provide colleagues in other subject areas with the opportunity to evaluate CD ROMs, whilst Julie provided her colleagues with the opportunity to word-process reports to parents (as per school policy) at home, rather than having to arrange to stay late at school. For Tom and Elaine (in different schools) a priority was to maximise student access to their computers, so they made them available during their lunch breaks, and Rose's computer proved so popular that she had to organise a booking system for students wishing to word process their examination coursework. Several of the teachers I interviewed made light of what they had achieved and were apologetic for not having done more, yet in all cases participation in the Pilot was in addition to their current work, with little or no release from other responsibilities.

As noted above, there is a danger in reporting the successes of a project such as MPTP for unstated assumptions of a 'technologically deterministic' nature to be made, and to imply, unintentionally or otherwise, that agency lies with the technology. Clearly the provision of portable computers made a difference, but the teachers themselves made the changes. Computers do not of themselves cause teachers to be professional. Computers do not of themselves cause teachers to use them, (and indeed a small minority made only minimal use of the computer provided).

The Pilot provided a context in which teacher professionalism could be clearly demonstrated, and we can identify several aspects of Hargreaves and Goodson's 'postmodern professionalism' in the above descriptions. Such professionalism has, of course, a cost. For most of the teachers I interviewed, the main cost was their time. In effect, the teachers were putting in many additional hours of their own time on their professional development, at a time when teachers' trade unions are pressing for reductions in teachers' workload. Several of the teachers expressed a wish for greater access to structured in-service training in connection with the computers. This is consistent with the finding of Watson (1993).

However, it was also apparent that the teachers were actively engaged in blurring certain distinctions. In many cases the *work/leisure distinction* was blurred, for instance in the case of Ian who learned about the Internet at home, by pursuing his interest in sport. Teachers have always taken work home, and the portability of the computers made possible a further blurring of the *spatial distinction between home and school*. For instance Tim and Martin in an already technology-rich school, were now able to spend extended periods of time properly evaluating CD ROMs at home. We see in these instances some of the consequences for teachers' work, consistent with the compression of time and space which is one of the characteristics of the 'condition of postmodernity' noted earlier. A further blurring of distinctions occurred around the *personal/professional distinction*, for instance in the case of Elaine who bought CD ROMs for family use on the computer.

Conclusions

At the time of writing the UK awaits the onset of its largest-ever education staff development initiative, the £230 million lottery-funded ICT training program intended to reach all the country's teachers between 1999 and 2002.

The Multimedia Portables for Teachers Pilot can be seen to have been successful in providing a context for teacher professionalism to flourish. This professionalism shows many of the characteristics of 'postmodern professionalism'. The Pilot itself could be said to have been somewhat postmodern in nature – flexible, adaptable, sensitive to context and non-prescriptive. It provided the conditions in which teachers could reflectively generate knowledge about the use of computers in their own particular settings. Like Elliot's action-research-based "innovatory progressive culture" in teaching, it would be resistant to "bureaucratic standardisation" (Elliott, 1989).

On the other hand, the awaited program of lottery-funded training for all UK teachers is based on the new Initial Teacher Training National Curriculum for the use of ICT in subject teaching (DfEE, 1998). This curriculum is prescriptive and very detailed. It is a specification to be applied equally in all subject areas, a sort of grand narrative for educational ICT. Essentially modernist in character, it relies on 'bureaucratic standardisation' and looks less likely to appeal to a wider sense of professionalism. It is also technologically determinist in nature. Computers, and training in how to use them, do not make things happen in the classroom – teachers do. Perhaps more of what is known about teacher professionalism, and about how teachers come to use technological aids, including computers, in their work, could have had a greater influence on what Vanessa Potter, Director of Policy and External Relations for the New Opportunities Fund, calls this "one-off catch-up" initiative.

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Multimedia Applications And Their Impact On The Sequencing Of Learning For Remote, Distance And Flexible Situations

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Abstract: This first of two papers based on our on-going work in the construction and development of interactive, multimedia applications. We provide a theoretical approach and a methodology for analysing data from students interacting with and learning from these applications with the objective of providing recommendations for system design and prescriptions for improving such design. The underlying constructs associated with the development of interactive applications are explored and examined in the light of student goals and the learning environment. The approach is illustrated by examining the underlying precepts of good case study development, use, and analysis. More specifically this approach provides valuable insights on how developers of such applications may best accommodate the varying levels of user requirements whilst at a general level highlighting the nature of human cognition and learning in the context of interactive, multimedia applications.

Origins of Idea

The idea for this piece of research stems from the ongoing work on developing multimedia applications for use in teaching and training situations. In particular the paper - Multimedia Pedagogy - Creating longevity in Cal applications, Toronto 1997, exposed some areas of study which appeared to be under addressed by current literature. In particular the learning process and its sequencing seemed to be an area which was accepted, or more appropriately, not questioned by the creators of multimedia applications. Yet, we can never truly anticipate how people will use these applications?

Our goal focused on the attempt to examine how interactive multimedia applications were used by students. To this end, we had the advantage of having a number of applications which could be field tested in terms of both domain and system application. This process had in fact already begun when students on our MBA courses were issued with the interactive CD Rom. The objective initially, was not to produce a statistically quantifiable set of data but rather to seek the paramaters of what a "good" multimedia application should offer the user. To this end we constructed a simple questionnaire **(See appendix 1)** to be completed by the student once the application had been used.

However, from hindsight the idea of using the questionnaire to evaluate the usage and efficacy of the interactive CD Rom seems akin to taking a sledge hammer to crack a walnut. At best we would collect data at a macro level based on recollections of what the individuals' process of learning had been and what they perceived as the values associated with such an application. Highly valuable information in its own right, but it would not of itself, provide enought information on the sequencing of learning.

Re-capping some of the material from the Toronto paper it could be seen that generall speaking, on MBA courses the case study method is used as the vehicle to develop student skills, learning and understanding. Case studies facilitate the marriage of theory and practice. They are then often augmented by having a guest speaker from the case company to address the class (see *diagram 1.*).

For the developer of case studies a variety of problems confront him. Not the least of which relate to the structure which has to accommodates crucial areas of :

- *level* (undergraduate; postgraduate; post-experience etc.)
- *complexity* (stage of the course it is intended for - introduction or final examination case.
- *currency* (what is the shelf life of a case - one year or five years?)

- *target group* (accountants; general business students or behaviourists etc.)
- focus(sales analysis, segmentation or marketing strategy etc.)
- *outcomes* (what is to be achieved by using the case - academic; social; etc.?)

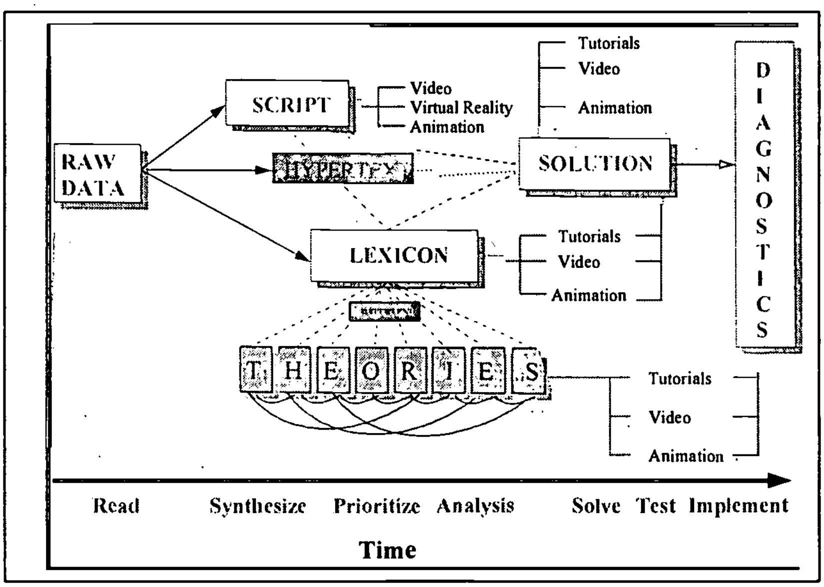
Diagram 1., represents the structure underpinning the development of case studies. It attempts to show how the addition of multimedia techniques and applications can enrich the delivery of such teaching tools.

Moreover, it attempts to provide a framework which shows this relationship between traditional case study constructs and the addition of multimedia techniques. Consequently, examination and evaluation of this potential was undertaken. The application of multimedia techniques with their inherent flexibility appeared to offer the best potential for ameliorating some of the problems associated with the use of case studies e.g. not all students learn at the same rate, nor do they start from the same educational base - in the area of business policy in particular they are likely to come from a range of disciplines, nor are all students as ready to contribute to class discussion. Multimedia applications appear to offer a tremendous potential for, not only achieving the objectives of case development but, augmenting them.

Flow Chart Construction of Interactive Multimedia Case Studies

Where diagram *1.* highlights the traditional relationship between case, theory and practice the addition of multimedia elements allows the introduction of additional material in a more student controlled environment (see *diagram 2*).

One fundamental of the system should be that it aims to test all students whilst allowing each student to progress at his/her own pace. Another should be that it promotes incremental development of problem solving skills thereby increasing the effectiveness of learning. Students should learn (partly by doing) to organise their own work patterns and determine the means to overcome the difficulties associated with solving complex, unstructured problems. The mere adaptation from paper to text on screen will not achieve these **(2)** . It is essential that a more proactive construction of interactive multimedia applications is pursued.



It has been claimed by many writers that it 'would be fair to say that the multimedia case is using computers to do what cannot be done either on the printed page or with blackboard and chalk.'**(3)**. To some extent this is a truism. Equally, it may be claimed that there can be little substitute for the symbiotic development of ideas and solutions generated by students in a lecturer led, class based, case discussion. However, if the objectives highlighted in diagram 1., are kept in mind then the limitations and advantages of both approaches can be viewed as providing a better opportunity for effective learning.

It is accepted that with case studies there is no definitive solution. There are though, a number of routes to a number of possible solutions. The interactive case has the advantage that it can present to the student what the company actually did and the rationale that lay behind its decisions, whilst still allowing the student to explore other options.

From the flow chart it can be seen that the key elements to be built are

- *case study* - video, scripting
- *script* - video, sound, graphic design, animation, virtual reality interface, hypertext links

- *lexicon* - video, dictionaries of theory, tutorials, self assessment
- *solution* - video, applied theories, system interrogation
- *simulation* - applied learning by competing against other industry competitors
- all of which must be supported by software development.

We felt that on the technical side we had produced an application which would satisfy Zimmerman's concept of "Learning through guided experience", (Brown , Collins & Duguid 1989, P457) who viewed the CD ROM as a vehicle to provide learning through guided experience. *Diagram 3*, crudely attempted to link outcomes with the potential requirements demanded of the product. Essentially, it tried to show that the key to good CAL lies in providing strong guided experience. It highlights the relationships between system, process, content and learning in relation to time and learning outcomes.

The System: should be robust, easily navigated, simple to control and fully interactive. It should facilitate the transfer of knowledge without requiring the user to develop computing software skills.

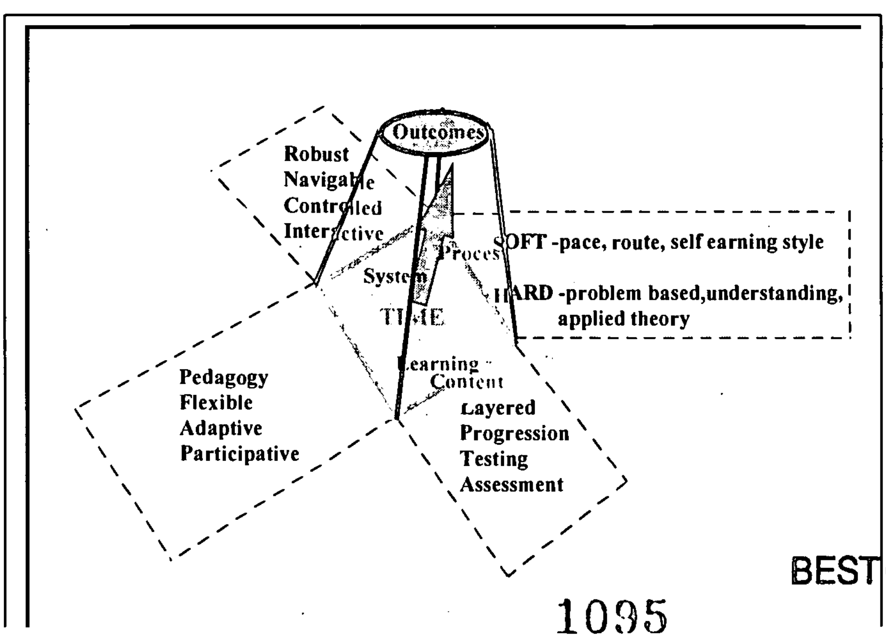
The Process: The process elements may be viewed as either soft or hard. The soft elements are those which the user should have some control over e.g. the pace of learning, the route which best suits his/her needs and the ability to accommodate the individuals own self learning style. The hard process elements acknowledge the requirements to produce problem based learning processes, user understanding of the process dynamics, and the process interface when developing applied theory. In reality it is probably the case that the hard elements far outweigh the soft ones which may in reality be more perceived than real.

Content: should be layered one level on top of another. User progression from one layer to the next, to some extent will be dictated by a combination of both the soft and hard process elements for example, a user may decide that his/her knowledge base is sufficient enough in a given area that work in this area can safely be avoided. In this instance he/she has made the decision not the system. However, at a later stage the system testing will assess whether he/she has the knowledge and understanding to adequately ignore this section and on the basis of this recommend appropriate action. This can either be done by the system setting tutorial assessment on that area alone, before progression is sought, or later when random tutorial selections are made. In any event, the system will assess content understanding.

Learning: is predicated on the system having the appropriate pedagogical input which is both flexible and adaptable. It should underpin the system content and should be adapted to user participation.

Time: is often forgotten in the development of CAL applications. Time is needed by the user to learn the system, its navigation, its processes, and its interface. Understanding the impact of time is crucial in construction phase of these applications. For example, it is unlikely to be appropriate to simply take the sequence of learning, as indicated by a curriculum and superimpose the curriculum content on to a CD ROM.

The essence of CAL, to a great extent, is to pass over the sequence of learning to the user when learning is freed from the confines of the classroom. But, without guided experience success in terms of learning is far from assured.



Initial feedback from the students indicated that the CD ROM allowed them to adapt their learning style. Essentially, this meant that each student created his/her own personal learning style by redefining their routes to learning and knowledge acquisition. The nature of the original case medium meant an holistic environment was presented to the student which represented a complex unstructured problem. The resolution(s) of this problem allowed the student to develop and test skills and techniques in a more challenging environment, one moreover, which provided learning by doing through its iterative process. Control of this process was seen by the students as being a positive feature of the learning process. One moreover, which allowed them to exploit time. They were no longer tied to taking notes in class but were free to roam through the linkages they wished to explore. They could ask questions and seek the answers at the pace and time dictated by themselves.

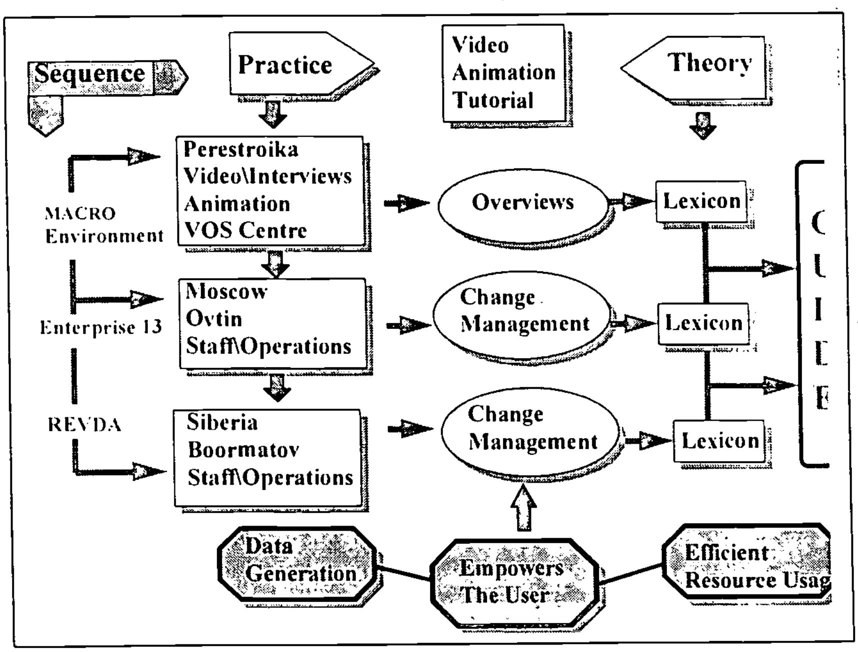
Progressing the Research

Questions arose on how valid are these assumptions on the sequencing of learning? How do we test their efficacy? The answers may, to a great extent, lie in the applications which had already constructed or were being constructed.

Structuring and sequencing the architecture of the multimedia package to fit and satisfy the wants and needs of the target user are of fundamental importance. In the case of VOS (see exhibit 1.) this architecture was envisaged as shown in Diagram 4. Here, three fundamental elements were being examined and juxtaposed :

- the Russian economy, the macro environment
- Enterprise 13 in Moscow (micro environment) and the
- Revdan enterprise in Siberia (micro environment)

The complexity of information underpinning such a teaching tool is enormous. To build an interactive multimedia application is daunting. But the rewards are high.



However, it was at this stage of development that an attempt was made to construct a means by which the user's path and attempts at elements such as tutorial questions could be recorded. This required that the interactive CD Roms' elements of the system and process (see Diagram 3.) had to be addressed.

In the event a tracking system which recorded every key stroke, to either the hard disc or 2(inch floppy, that the user made whenever the disc was accessed was incorporated This was important when assessing for example content usage, tutorial performance, layering etc. The objective was to give the system the ability to track and give feedback to the lecturer or trainer on user progression and performance.

However, it soon became apparent that this tracking system could allow us to directly observe how the interactive application was being used. The application was designed to be an iterative one where the user would access the materials e.g. the lexicons and tutorials, on numerous occasions (See Figure 1., *content*) building their

skills, confidence and research abilities. This, taken in conjunction with the questionnaire, allows a far stronger analysis of the application to be developed.

Once the questionnaire has been completed by the student comparison can be made with the data recorded on the disc. For once the validity of questionnaire responses can be compared with the actual experience of the student utilising the interactive disc.

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A Video Exploration of Classroom Assessment

A Video Exploration of Classroom Assessment includes six workshops and multiple examples of assessment techniques that teachers can try out with their students. Video examples give teachers a window into a real classroom, so that they can see what the techniques look like in practice. More than any one specific feature, the real, unstaged nature of the video sets this CD-ROM apart from other assessment tools. The CD-ROM offer a variety of perspectives on the different techniques through interviews with teachers and students. *A Video Exploration of Classroom Assessment* gives teachers the tools to implement a new assessment technique or system in their classroom.

Utilizing Electronic Portfolios for the Assessment of Teacher Educators: A Case Study Approach

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Abstract: Clearly one of the most valid approaches to assessing student and teacher performance is through the use of portfolios. As more and more schools move towards the use of portfolios to assess both their students and teachers ability to meet program standards, educators have been struggling with how best to make this transition successful. John McSweeney in an article in the Executive Educator states "...evaluating young readers is one task in which electronic portfolios are clearly superior to paper portfolios" (Bushweller, 1995). During the past three years I have been assisting students in developing both traditional and electronic portfolios and also would agree with Mr. Mc Sweeney's statement that electronic portfolios are clearly superior to paper portfolios. Furthermore, students who have successfully completed an electronic portfolio support my personal feelings of their superiority to traditional portfolios. Their feedback speaks to having empowered them to better utilize technology in their classroom. At Saint Mary's University of Minnesota, our utilization of portfolios to assess both preservice and inservice teacher educators with their ability to meet program standards has been a wonderful process. Finding the best possible tools to accomplish this task was the foundation for this case study. My findings that relate to the three students in this case study who had completed traditional and electronic portfolios for a master of education degree clearly supports the continued use of technology in portfolio design.

Introduction

Portfolios have become a major focus within our program of study. We use it as the key assessment tool in determining whether a student has successfully met our standards. Our movement to this tool for assessment has been driven in large part through our beliefs of the constructivist notion of students learning from experience, creating their own meaning, and developing both expertise in and commitment to the process of reflection (Wade & Yarbrough, 1996). As more and more schools move towards the use of portfolios to assess both their students and teachers ability to meet program standards, educators have been struggling with how best to make this transition successful. A major change to utilizing a portfolio approach for authentic assessment at Saint Mary's University of Minnesota has resulted in some amazing observations.

This paper deals specifically with the analysis of three students who have completed portfolios in the form of a web-based portfolio; a CD-ROM based portfolio and a traditional portfolio. While all three of these portfolios were able to demonstrate the success a student had in meeting our educational program standards, they all were quite unique. This paper takes an in depth look at the benefits and drawbacks for each of these types of portfolios from both the perspectives of the student and the instructor.

Web-Based Portfolio

The student who generated a web-based portfolio is an experienced teacher at the high school level. His work with technology in the past was limited but he posed a strong interest that served him well in his pursuit of this

electronic portfolio task. Much of his experience with developing his portfolio was self-directed learning. From his experiences and those of the author's experiences with dealing with web page development, the following strengths and weaknesses are laid out in web-based portfolio design.

One of the key strengths of developing a web-based portfolio over a CD ROM portfolio was observed to be the highly transmittable nature of the web. This allowed easy access of his portfolio to a wide array of individuals and the ability to maintain an up-to date portfolio. This ability of maintaining a web-based portfolio allowed outside observes to see the most recent version of the student's portfolio. In our program where we are doing multiple assessments of the student's portfolio it provided the student an opportunity to maintain a very fluid structure in changing his portfolio.

A second major benefit of the web-based portfolio was the ability to create an extremely interactive site that was easy for the instructor to quickly move about to specific documents. This was extremely valuable in assessing the web-based portfolio over the traditional paper portfolio.

The drawbacks to developing a web-based portfolio over a CD-ROM and traditional portfolio were the need for the user to be a self-directed learner. The amount of trouble shooting the student had to engage in during the development of the portfolio was quite extensive. The continual changes to web-based software added to the challenges of maintaining abreast of all the features that were available to him. On the other hand, what was learned by the student of the web-based portfolio was extremely valuable to him. He felt that he gained many tools that will assist him in better communicating with his students and parents over the Internet. A valuable lesson in today's fast paced world.

A second drawback to this form of portfolio came about after the student was well into the project. The school district he is teaching in put into place a policy of not allowing student pictures to be residing on their Internet site. This was the site he was using to store his portfolio. The storage space also played a significant hurdle to his web-based portfolio as he began to include digitized video. Before long his portfolio had increase from less than 3 megabits to over 80 megabits with the inclusion of video, audio and graphic files.

A third drawback to this form of portfolio then emerged for this student as to the speed at which one could observe his portfolio. With digitized video, it was taking ten to fifteen minutes to download video files that demonstrated his teaching abilities.

My analysis of the effectiveness with regard to web-based portfolio as a program wide alternative to traditional portfolios is as follows. I have found that while the interactive and ongoing developmental natures of this design are very positive for the web-based portfolio, the major drawbacks dealing with privacy and download speed are areas that need to be addressed before I would recommend it program wide.

Traditional Based Portfolio

The second student in this case study created a traditional portfolio and is an experience educator at the high school level. This portfolio included the student work samples, letters, papers, assignments, etc... In essence, it included almost all of the same artifacts that were included in the web-based portfolio with the exception of digitized videos and audio files.

The strengths of the traditional portfolio was that it took very little time to get students acclimated to the process of collection, it was very easy to see the physical growth of the portfolio, and less time was spent turning artifacts into digitized files (i.e. pictures).

Perhaps the major drawback dealt with the ease of use. For the observer, it took considerable amount of time to go through the portfolio, searching for specific evidence of growth. Unlike the technology generated portfolios, the traditional portfolio virtually had to have the student there to locate specific pieces of evidence. This made it almost impossible to assess a student's work effectively without considerable time devoted to this process above and beyond the time needed to be spent with an electronic portfolio.

A second drawback was the lack of specific types of evidence such as video files and audio files that the portfolio did not include. Because the availability of digitized videos and the ease in which they can be produced it allowed the instructor an opportunity to quickly see specific videos related to the growth and strengths of the student's performance.

The third drawback is the massive nature of the portfolio. The idea of storing a traditional portfolio is virtually impossible because of its sheer size. Also, a portfolio should remain with a student so that they can

continue the process of building their record of professional growth. With the electronic portfolios, the ability to make a copy of the computer files is both valuable and very easy to accomplish. This allows both the user and the institution to maintain their own records of the student's growth.

The last drawback I will articulate is in the form of a lost opportunity to learn more about technology. Students engaged in the development of both the web-based and the CD-ROM based portfolio both felt a tremendous gain in technological knowledge that they would not have experience if they had chosen to complete a traditional portfolio.

My analysis with regard to the effectiveness of the traditional portfolio is still very positive even though they have lost out on increasing their technological competence. I have observed not only this particular student's gain in professional growth and insight, but also over one hundred and thirty other students who have gone through a similar process. This exposure to utilizing portfolio for professional growth has convinced me that the use of portfolios whether traditionally or electronically had allowed a diverse group of learners to best share and reflect upon their own growth. This process can only be enhanced in many ways by including one of the two forms of electronic based portfolios that were utilized in this study.

CD-ROM Based Portfolio

The student who had generated a CD-ROM based portfolio had completed it utilizing Multimedia Director software. At the time of her portfolio development, she had only one year of teaching experience at the elementary level. This multimedia software allowed the student to generate a very professional portfolio that not only reflected her professional growth but also became a showcase for her capabilities as a teacher.

One of strengths of utilizing a CD-ROM based portfolio included an extremely interactive medium for the instructor to review the portfolio. The menu of the portfolio allowed the instructor to quickly interact with a series of standards the portfolio was organized under. I was able to quickly move about the software and focus on the issues I wanted to observe without any need for guidance.

A second strength was the storage capabilities of utilizing a CD-ROM. With 650 megabits of memory storage, the CD-ROM allowed virtually unlimited access to storage capabilities. This is in contrast to the space constraints the web-based portfolio student encountered when he began to add digitized videos to his portfolio. Granted, someone who decides to digitize hours of classroom teaching performance for his or her portfolio would find a disk space to be limited. I would not advice someone to place that type of video into his or her portfolio. I would rather see the student reflect upon what they would like those who view their portfolios see which would require the student to be more reflective about their teaching.

A third strength was the ability to utilize many different types of software with the development of her portfolio. Currently, I have several students working on CR-ROM based portfolios and they are choosing to utilize a wide array of software products including HyperStudio, PowerPoint, Word, etc...

A final strength is the technological growth this student experienced. This student entered the class with very little exposure to technology. Following this experience she was well grounded in many technological areas. Not only was she able to run the software she used to create her portfolio, she became a very effective problem solver when dealing with technology.

Summary

As Kenneth Wolf (1996) had written "A teaching portfolio should be more than a miscellaneous collection of artifacts or an extended list of professional activities", students who I have worked with have receive a much greater sense of who they are through this process. When dealing with the development of an electronic portfolio, Master degree students gained not only a greater understanding of who they are as a teacher, but also a far greater understanding of technology. When it comes to making a decision of creating a web-based portfolio versus a CD-ROM based portfolio one needs to consider whether the gain in learning about web page development is something that they will use in the future. In all three cases, the students were very happy to have gone through their experience with the development of their portfolios. As an instructor, while I found value in all portfolios, I felt the use of creating an electronic portfolio provided additional growth for the learner and greater ease in the assessment

process.

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"Whose Mummy Is It?" A simulated Tour of Egypt.

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Whose Mummy is it? is an adventure story in which the player/student/protagonist must solve a mystery while on a tour of Egypt. In order to solve the mystery, they must first acquire information such as learning about mummification from a Handbook of Mummification, which is contained in the backpack they're given before they "leave home" to go on the tour. They learn about religion and the Egyptian pantheon by visiting the "Hall of the Gods," a virtual room in the Cairo Museum where the gods come to life and introduce themselves. In the same museum, they tour a virtual "Writing Room" where they learn about Egyptian hieroglyphics and how to decipher them. In short, the student is given a clear goal or problem to solve and this goal "organizes" and focuses their learning.

We are attempting to bridge the gap between programs like *Where in the World is Carmen SanDiego* which are popular and engaging but of dubious educational merit and information-rich programs like *Encarta*, which seem to be useful only for doing term papers.

Developing Educational Web Sites with Advanced Multimedia and Interactive 3D Environments

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Abstract:
A new level of interactive multimedia is on the forefront of web authoring and is now available for educators to access and create as supportive information to their curriculum. This paper presents information on the development and current status of advanced web-based interactive 3D environments, known as Virtual Reality Modeling Language (VRML), and their use in classroom presentations and distance learning.

VRML is a technology where by 3D models of objects are given attributes such as color and texture then placed in a digital scene resulting in a visualization of the original environment. The objects can be assigned animated behaviors via events making the visualization into a simulation of activity. An intuitive on-screen user interface allows a learner to view and navigate through the environment while interacting with the objects. Specific applications of the current VRML projects are discussed for instructional use in Science education dealing with Astronomy, Chemistry, Physics and Biology, also, an Art and Humanities applications is discussed.

Introduction

The development of advanced web-based interactive 3D environments, known as Virtual Reality Modeling Language (VRML), provides dynamic, engaging three-dimensional virtual environments on the World Wide Web. VRML is a new level of interactive multimedia for web authoring and is now available to educators to access and create as supportive information to their curriculum for use in classroom presentations and for distance learning.

VRML enhances HTML with 3D content in the form of scenes, animations and events. It is a technology whereby 3D models of objects are given attributes such as color and texture then placed in a digital space resulting in a visualization of the original environment. The objects can be assigned animated behaviors via events making the visualization into a simulation of activity. An intuitive on-screen user interface allows a learner to view and navigate through the environment while interacting with the objects (Heartman, & Wernecke,. 1996). Specific applications of VRML projects are for instructional use in Science education dealing with Astronomy, Chemistry, Physics and Biology. Art and Humanities subjects are also being enhanced through on-line 3D visualizations and simulations created by educators and students.

Theory and Context

Why is VRML Important? VRML operates from a human factors standpoint and is vastly demonstrative of visualization and simulations. It is high-level multimedia comprised of detailed information. Text is the base-level media. Adding images to text yields more information. Moving images, i.e. animation transmits even more information. Sound adds yet a higher level. This amount of information can be presented with Hypertext Markup Language (HTML), however, VRML extends into the third dimension placing visual elements into a Cartesian Coordinate system and thus delivering a scene in 3 space (Lea, Matsuda, & Miyashita,. 1996). VRML goes beyond this allowing a user to interact with the virtual objects and experience the scene through self-navigation. VRML environments combine the benefits of a hypertext construct (Spiro, & Jehng, 1990) with a constructivist concept.

History of VRML Development

HTML is the basis for the current Internet content and provides a document-based interface that includes raster graphics images. While the document criterion is appropriate for some forms of interaction, it has limitations in its information structuring and its interaction capabilities. VRML enables a high level of interaction by advancing the web beyond the document-oriented paradigm into virtual worlds based on 3D interactive computer graphics. The applications of VRML include entertainment, business graphics, scientific, educational, and reconstruction of historical domains. VRML has also become a cyberplace for shared virtual worlds.

VRML came from the planning and efforts of many people and organizations. The source code of the 3D models is based on Silicon Graphics Open Inventor's file format. This key code from SGI laid the foundation to the 3D graphic standard for models. The Open Inventor file format is made freely available to Web developers. In addition to the file format, a VRML parser, QvLib, designed by Paul Strauss and Gavin Bell, is a reference implementation for continued research and development. It was through these software-engineering feats that created the VRML industry and the growing number of sites on the Internet. VRML has developed into a platform-independent file format for the viewing and navigating through 3D worlds over the Internet.

VRML has evolved in two phases. VRML 1.0 was adopted in the Spring of 1995 and provided the basic file format for static models. VRML researchers and developers implemented upgrades for incorporating animated behaviors into VRML. The VRML research group, in Spring 1996, endorsed the "Moving Worlds" proposal presented by a consortium of companies led by SGI. VRML worlds can be interactive, animated and include embedded hyperlinks to other Web documents. The Moving Worlds Specification resulted in the final version of VRML 2.0 on August 4, 1996. The specification was released by the VRML Architecture Group at SIGGRAPH 96 in New Orleans, Louisiana. The VRML 2.0 specification is the current standard for the growing members of VRML sites on the World Wide Web.

Educator-authored Environments

It may be a concern that creating a VRML environment and placing it on the Internet would be a tedious task. While authoring custom environments is not trivial, nevertheless, they can be accomplished. Unless there is the need for unique 3D models, such as for a specific architectural structure, there are many pre-constructed models available to populate a VRML world. There is a plethora of VRML models available free for download from several web sites and hundreds of models are packaged with VRML authoring software. Also, constructing the environment has become more user friendly through programs that allow for easy to use drag and drop interfaces. The newer software programs are fairly intuitive or have a smooth learning curve. However, there are professional VRML design programs that are complex and may require programming expertise. Custom models can be derived from several sources including 3D modeling services, which have web sites providing information on their available files. Viewpoint Data Labs is one of the source supplying 3D models to companies and organizations.

For a large VRML project it may be prudent for educators to consider forming a group of proficient technologists for delegation of project development. In this consideration, an educator may act as a Subject Matter Expert to an interdisciplinary team of students gathered to produce an advanced project for credit. A proper mix of required skills may be selected from Computer Science, Art/Graphics with 3D modeling skills and Communications-Multimedia for scripting and staging & audio/video skills. A collaborative team effort can bring a detailed site to completion.

Educators who wish to create their own site for use with classes or instruction have a choice of authoring software and the selection of software should be made depending on the complexity of the desired VRML environment.

Cosmo Worlds (http://www.cosmosoftware.com) is a professional-level comprehensive 3D Web authoring and publishing tool. The Cosmo Suite of programs was originally an SGI product utilizing native VRML

2.0. It has been ported from the SGI platform and now is also available on the PC. Output files are optimized and packaged for Web deployment. An intuitive interface allows novice users to design simple or complex worlds. Multimedia elements are added such as billboard images, object links to web pages and viewpoints. Audio files can be included to bring aural dimensionality into the scene. Since VRML 2.0 brings animation into the process, Cosmo Worlds has a, keyframe animation function. Behavior scripting, scene assembly, lights and navigation settings are all programmed in through a user interface.

Beyond 3D Extreme 2.0 (http://beyond-3d.com) is another modeling, rendering and animation program for VRML 2.0 file output. It aids custom model-building and contains modeling tools to build and manipulate objects. The user can create custom images for textures or use pre-designed materials from a library to give objects realism. Lights can be selected and positioned to illuminate the scene and effects such as shade, reflection, refraction, fog, etc. can be simulated to augment the realism. Animation of objects cam be achieved through morphing, color interpolation, keyframing, and camera trajectory movements. The scene is then tested with a built-in VRML browser.

3D Webmaster from Superscape (http://www.superscape.com) is a real-time, interactive 3D-authoring tool for developing 3D Web sites and placing 3D objects within in HTML sites. The program contains ready-to-use content of 800 virtual clip art objects, 500 textures, 600 behaviors and 200 sounds for simple authoring. The 3D Webmaster files may be plugged into HTML, Java and JavaScript.

Hardware Requirements

Although VRML files are designed to be compact and be viewable on many computers, it is mandatory, however, that a powerful graphics workstation(s) be authoring machine(s). Workflow is critical and processor speed, graphics boards, disk storage and memory should be considerable. SGI O2 series offers acceptable capacity, as does high-level PCs such as Intergraph. Consult with professionals in the VRML community through organizations such as the San Diego Supercomputing Center's VRML Repository and take note of the recommendations for hardware systems by the software that is used to author the site. An Open GL card is a must to manipulate large 3D models. Once the VRML environment is to the point for viewing, perform benchmarking testing on several platforms using several browser plug-ins and internet connection rates to discover the portability of the environment.

Enhancing Curriculum with VRML Environments

Various research institutions, organizations and companies have established VRML sites on the Web. A few sites showcase the work of individuals. Several sites are of high educational significance. Selections of the fine offerings from the VRML community are as follows:

Sam Chen's CyberAnatomy (http://reality.sgi.com/sambo/Oobe/CyberAnatomy/intro.html) is an exceptional creation of image, text, 3D modeling and animation. Chen is one of SGI's authoring specialists and has designed this site to be compelling and information rich.

3D scenarios of biomolecules (http://ws05.pc.chemie.th-darmstadt.de/vrml/) developed by researchers at the Institut für Physikalische Chemie and Darmstädter Zentrum für Wissenschaftlisches Rechnen Technische Universität Darmstadt. This site shows three dimensional object oriented scenarios and interactions with the basic elements. This is a new technique to provide chemistry-related information presented in VRML. The biomolecules demonstrate molecular recognition in a distributed environment and it is the active site of the enzyme Cytochrome P450.

Math education also is supported with 3D through the vrml.calculus.net (http://vrml.calculus.net/). Robert Curtis, Bill Davis and Lee Wayand curate the digital calculations to aid visualization and understanding of the torsion of a curve. The site brings presentation to the torsion of a curve through animation. This subject is usually taught and presented with formulas; yet, with animation, movement along the curve yields visual discovery of the torsion.

3D crystal structures in VRML (http://www.ill.fr/dif/3D_crystals.html) may be generated from a variety of standard crystallographic formats. This site uses xtal-3d developed by Marcus Hewat at ILL using the CCSL Cambridge Crystallographic Subroutine Library. Crystal structures can be viewed and manipulated in 3D VRML.

CyberAstronomy, (http://reality.sgi.com/sambo/Oobe/CyberAstronomy/intro.html) is an interactive 3D tour of our Solar System. CyberAstronomy provides valuable data and facts on each planet, their prominent moons while simulating satellite movement and the Shuttle orbiting Earth. Music files play in a version of this environment and planets are texture mapped to look realistic. The interface comprising frames similar to Cyber Anatomy give the site a balanced, information-rich appearance (Chen, Myers, & Pasetto, 1997).

NASA's International Space Station (http://station.nasa.gov) presents a complete Station model in Earth's orbit; several versions of the Station are maintained for viewing according to the graphic level of the user's computer. Separate elements and modules are listed under contributing National Space Agency and both the Shuttle and X-38 vehicles are included.

NASA's Mars Pathfinder Landing Site (http://mars.sgi.com/worlds/4th_planet/html/mp_vlo_frames.htm), shows a visualization of the mission. This VRML visualization is an interactive model of the Mars Pathfinder landing terrain maps estimating Sojourner's course and last position. Links are associated this model to access the bottom frame with information concerning the regions.

Stanford University's Virtual Creatures Project (http://www-med.stanford.edu/creatures/index.html), is a wildlife habitat funded by NSF as a research and development project. The Stanford team investigates the educational potential of VRML and/or responsive multimedia in providing virtual living creatures. Their goal is to develop a visualization of a high-resolution, computerized 3D concept of a living creature and its internal and exterior structures. The site is designed for teaching whereby students can explore, visualize, touch, and alter these virtual creatures in ways that are impossible with real laboratory animals. The content is planned to enhance biology, physics mathematics, biomechanics, and biochemistry.

Art, literature and creativity have found a natural fit within the VRML community. One of the most moving pieces is Why We Die (http://www.wolfenet.com/%7Eyoame/raven/) marvelously depicted in VRML. While this is not an interactive file, but a scripted one, it adequately presents the story from the Pacific Northwest by Alan Taylor.

The Palace of Ashur-nasir-pal II by Learning Sites Inc. (http://www.learningsites.com/NWPalace/NWPalhome.html) is building a digital architectural structure in VRML. It is characterized to be realistic and of historical reference. Content such as this can be noted as a research and development project for historians and students of history.

Future Considerations

The World Wide Web content for the new millennium is poised to far exceed our expectations. As global classroom learning evolves, the use of 3D interactive virtual environments will continue to aid and enhance distance learning with complete sensory communications systems. Complex subject matter is made more understandable through realistic visualizations and interactive simulations. Fully networked sites with real-time interactivity and stereoscopic viewing may become the norm in distance education. The next step in the development of VRML sites is being designed to offer highly realistic, interactive worlds lending to discovery learning and procedural training for the next generation of students.

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Multimedia: What Do We Teach the Next Generation?

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As the teaching of multimedia has progressed over the past few years, the students who enroll in educational technology classes have changed, too. Early on, all of the hardware and software were new and exciting. Teachers had little in their buildings to work with and therefore they came to the universities to learn about the new technologies. As technology funding increased at the local school district level, many of these technologies found their way into the classrooms of the technology oriented teachers. In many locales the public schools have now surpassed the universities in the amounts and types of hardware and software available to teachers.

As the instructor of a graduate multimedia course, I have noticed a distinct change in knowledge and capabilities over the past few semesters. The great majority of my students come to class already knowing how to use Powerpoint, digital cameras, scanners, Zip drives, and Hyperstudio.
While there is a great deal more to teach in such as course, one must wonder what the multimedia course will look like in the coming years.

This evolution is reminiscent of the programming that we used to think was so important in computer education. As the software improved, the need for teachers to be programmers faded. Teachers didn't have the time to produce quality software in addition to their regular duties. Is multimedia or perhaps educational technology in general facing a similar fate?

As professors of educational technology we need to ask ourselves a series of difficult questions:

1. Where are we headed with multimedia as a) a teaching tool and b) as a tool for student presentations?

2. How does the Internet, as a vehicle for multimedia, figure into these courses?

3. If students and teachers are coming to us with more knowledge do we instead teach more or different hardware and software applications? Which ones?

3a. Because we frequently have "newbies" and experienced users in the same multimedia classes, should there be prerequisites for entering a multimedia class? Which skills should be required?

4. Which programs are easy enough that teachers will have the time to learn and use them? Will teachers use hardware or software with a steeper learning curve? Will they have the time to produce presentations of sufficient quality to warrant the use of these technologies?

5. How can we use multimedia more effectively? That is to say, can we produce educationally sound products in less time than is currently required?

While this is not an exhaustive list of questions we should be asking ourselves, it is necessary that those of us who teach courses in multimedia attempt to determine the nature of these courses before they become obsolete or ineffective in training the teachers with whom we work.

The answers to the above questions will not be completely answered until the panel at the SITE conference in San Antonio. However, there seem to be some answers which we can anticipate. First, we are in the business of teaching multimedia for instruction. Therefore, we should not be in the business of teaching programs for their own sake. Rather, we should be teaching the use of multimedia tools as a means of creating multimedia projects or presentations which can enhance the learning of students. This may mean the creation of presentations by teachers for students. It may also mean the creation of presentations or projects by students for the purpose of sharing the information they have acquired. Teaching the programs may be necessary, but only as necessary for fulfilling the objectives of the projects.

We have always taught classes which contained students with varied knowledge bases and abilities. Why should that be different when we teach multimedia? We know how to group students in skill or task groups in order to meet individual needs. Much as we may not wish to provide differentiated instruction to meet the needs of novices and experienced users in the same class, if the needs exist, we are obligated to do so. The only other way would be to create two separate classes, and that is not feasible in most universities. Like the public schools, we take our students where they are and take them as far as we can while maintaining rigor and standards. Advanced students should be able to do more complex projects or learn additional tools because they won't need to spend time learning the basic multimedia programs. Novices should still be able to produce quality work, but with fewer tools at their disposal.

We can affect the development of new tools in multimedia if we take the time to communicate with software publishers. Typically, we sit on the sidelines waiting for new programs or versions to be published. This may be disastrous if one looks at past history. Many new versions of programs have been published without regard for the end-user. Publishers seem to thrive on making their programs more powerful with each new version, but with new power usually comes more difficulty for the user. We, as educators and consumers of multimedia need to let publishers know that more power is wonderful, but only if the program remains easy to learn and use.

Bard Williams (1993) warns us about the disconnected use of multimedia as innovation-based staff development. "The focus of innovation-based staff development is looking at the big picture, finding high-interest technology and then designing down. Fostering curiosity and getting people enthused about knowledge navigation is a lot easier than suggesting participants memorize command key sequences. Like outcome-based staff development, the ultimate goal is the improvement of instruction as a whole with emphasis on an end-product and creating transferable learning experiences. Capturing participant curiosity through the use of innovative technologies like telecommunications and multimedia can be just what the doctor ordered to get the staff fired up about incorporating technology throughout the curriculum."

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Embedding Multimedia Cases in Teacher Education: Supportive Role of the WWW

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Abstract: This paper reports on the first results of an ongoing development research study related to the MUST project. The MUST project (Multimedia in Science & Technology) aims at developing multimedia cases for the professional development of prospective teachers in elementary science and technology education. Multimedia cases are not (yet) widely used in educational settings. For many teacher educators the effort of making such cases available to their students in a meaningful way is an innovation in itself. In order to help anchoring MUST in the teacher education curriculum and provide practical examples, the MUST project makes use of learning routes. To make the learning routes and related experiences available to interested teacher educators, this information is made accessible through a web-based environment.

Introduction

The MUST project (Multimedia in Science & Technology) aims at developing multimedia cases for the professional development of prospective teachers in elementary science and technology education (Van den Berg 1998). Cases and approaches to case-based instruction bring the complexity of professional practice into educational programs (cf. Lacey & Merseth 1993). Especially in multimedia cases, information is not encoded in predefined educational sequences that are used to transmit knowledge to students. Rather, such multimedia productions intend to actively engage students in creating knowledge that reflects their comprehension and conceptualization of information and ideas (Jonassen & Reeves 1996).

Multimedia cases are not (yet) widely used in educational settings. For many teacher educators the effort of making such cases available to students in a meaningful way is an innovation in itself. These teacher educators look for examples to hold on to when they decide to use multimedia cases themselves as well as insights into the practical consequences of embedding these cases in the curriculum.

Learning Routes: Anchoring the use of MUST

In order to help anchoring MUST in the teacher education curriculum and provide practical examples, the MUST project makes use of learning routes. A learning route is a coherent whole of meaningful learning tasks to be performed by student teachers in order to reach intended learning outcomes.

As far as the application of MUST in teaching and learning is concerned, it is recognized that there are differences in beliefs about quality science teacher education and science teaching. Therefore the MUST project favors *flexibility in use* of the multimedia cases and does not want to impose a prescribed path on teacher educators and prospective teachers. Therefore, each learning route can be based on different starting-points. For instance, one learning route can start from the idea that students will state their own goals when working with MUST and that they will work individually during a part of an entire module. However, in another learning route the focus can be on collaborative group learning where the teacher educator and the different groups negotiate about their intended learning outcomes of an entire module.

Flexibility in Use: Classifying Learning Routes

In order to elaborate on the potential flexibility in use of MUST we defined several dimensions, based on discussions with teacher educators (see Tab. 1)

Dimension	Characteristics
Study load (in hours):	1 – 5 – 10 – 15 – 20 – 25 – 30 – 35 – 40
Grouping:	• Classroom demonstration • Classroom discussion • Individual work in classroom • Small group assignments • Individual assignments
Role of the student	• Learner • Critic • Designer
Pedagogical skills	• Preparing the lesson (such as, analyzing and deciding on materials, sequencing, planning, etc.) • Execution of the lesson (such as, organizing the lesson, motivating learners, demonstrating, facilitating research, differentiating between learners, etc.) • Reflection (such as, deciding on good aspects, weak aspects, revision, etc.)
Guidance	• Student decides on own study-activities • Teacher/learning route decides on the study-activities

Table 1: Dimensions for classifying learning routes

Each learning route can be characterized according to these dimensions. It is assumed that this characterization of learning routes will:

- Assist teacher educators in getting a notion of the rationale behind each learning route;
- Stimulate the discussions between teacher educators about the potential use of MUST;
- Support teacher educators in choosing learning routes that align with their own teaching philosophy.

Exploration of Learning Routes

If a teacher educator decides to use MUST as a support tool to realize a certain learning goal, then learning routes may further the effective use of MUST. To explore this line of reasoning, we organized two research activities: an imagination session and a workshop.

During the *imagination session* we asked four teacher educators (who are members of the design team and familiar with the potential of MUST) to describe the pictures they have in mind when thinking about the way they would like to use the MUST multimedia cases in practice. Each description was characterized using the following dimensions: study load, grouping, role of students, pedagogical skills, and guidance. Analysis of the imagined pictures of the learning routes shows that:

- Study load: All of four teacher educators think of the use of MUST as a part of an entire module (40 hours of study load).
- Grouping: As far as the grouping of students is concerned, the flexibility in use of MUST is apparent. Two teacher educators want to use MUST to demonstrate parts of it in a classroom instruction setting. One of them subsequently likes students to use MUST individually. This teacher educator is the only one who proposes to use MUST with various grouping strategies. Both other teacher educators either want to use MUST in individual assignments during classroom teaching, or want students to work in pairs. The fourth teacher did not indicate a preferred grouping strategy.

- Role of students: The flexibility in use becomes also clear when looking at the role of the students. One teacher educator proposes that the students take the role of a learner and a critic. Another teacher educator likes students to be designers and to be critical on their work. A third teacher educator sees the learners as designers of their own lessons while they are using MUST. One teacher educator does not have a clear impression of the role of the students, yet.
- Pedagogical skills: As far as the pedagogical skills are concerned, one can see that MUST could be used to gain various competencies. On the one hand, one teacher educator proposes to use MUST to get experiences in a wide array of skills (the entire preparation of a lesson). On the other hand, another teacher educator wants to put on MUST to give the students the opportunity to get acquainted with one specific pedagogical skill (the organization of a lesson).
- Guidance: All teacher educators like to start with a learning route in which they, as a teacher, have a firm grasp in the intended learning outcome. Their consensus on this is consistent with the idea that the use of MUST in practice is in itself an innovation for the teacher educators. From this perspective it is understandable that they want to start from a relatively secure situation.

Based on this analysis, it may be concluded that the pictures the teacher educators have in mind when thinking of embedding MUST in their curriculum show variation. This illustrates the predicted flexibility in use of MUST. As a next step, each teacher educator will be invited to design the entire learning route they proposed and to implement the learning route in his or her situation. This will help the four teacher educators to gain their own experiences with the use of MUST. The teacher educators and their students will be followed in their efforts. This will shed light on the practicality of the various learning routes from the teacher educators' perspective and students' perspective.

During a one-hour *workshop*, 15 teacher educators were introduced to the MUST prototype. All participants were free to walk through the program and explore its functionality. After this period of free exploration, the concept of learning routes was introduced and illustrated with several examples. Subsequently, the participants were invited to use one or more of these learning routes to gain deeper understanding of their possibilities. Participants were asked to write down their first reactions and reflect on the learning routes they followed. During a group discussion, we collected the remarks and comments and reflected on them. Analysis of the results put forward several discussion points:

- Most teacher educators needed much more time (than one hour) to explore the multimedia case and get a basic understanding of its potential use. Most teacher educators liked the notion of learning routes but encountered difficulty in reflecting thoroughly on the examples of the learning routes. This result shows that the basic ideas underlying MUST are much more complex than expected. Teacher educators need more time to get acquainted with the program before they can think about the way they would like to anchor such multimedia cases into their curriculum.
- Consistent with the results of the imagination session, the teacher educators who were just introduced to the multimedia case especially preferred the learning routes that provide teacher control. Teacher educators seemed to be somewhat hesitant in handing the control to the learners.
- Teacher educators seemed to like learning routes that stay close to the content of the multimedia case. Some of the learning routes started from the idea that students can transfer the information in the case to other situations. For instance, if the multimedia case shows a lesson for third grade learners, a learning route might invite student teachers to prepare a lesson on the same topic for grade six. Some teacher educators indicated that they would not use such as learning route, because the multimedia-based case does not provide enough information to perform such as task.

Based on these tentative results we may conclude that the multimedia cases of the MUST-project should be seen as innovative products. For many teacher educators the use of these cases in order to reach certain goals is an innovation in itself. Teacher educators should be given the opportunity to get successful experiences with the use of such cases in their curriculum. Learning routes might help teachers in gaining such experiences, especially if they stay close to teacher educators' comfort zone.

Future Direction: Learning Routes Available through the Web

The MUST-team plans to work towards the situation in which each teacher educator can explore the flexibility in use of MUST for his or her situation. Experiences they gain from this exploration can be of great value for other teacher educators who want to anchor the use of MUST in their curriculum. In order to make the learning

routes (and related experiences) available to interested colleagues, this information will be made accessible through a web-based environment with access to a database with the learning routes. To give the user insight into the rationale behind the learning routes, the dimensions mentioned before will be used to characterize each learning route in the database.

A teacher educator who wants to view some exemplary learning routes can go to the MUST website (http://to-www.to.utwente.nl/TO/project/must/) and find the learning routes with the use of a search engine (Fig. 1). When the user indicates that he or she wants a certain learning route, the system will start a word processor and open the specific file. In this way, all functionality of the word processor is available. The user can immediately change the learning routes to her or his needs and wishes and save it on the hard disk or make a print of it.

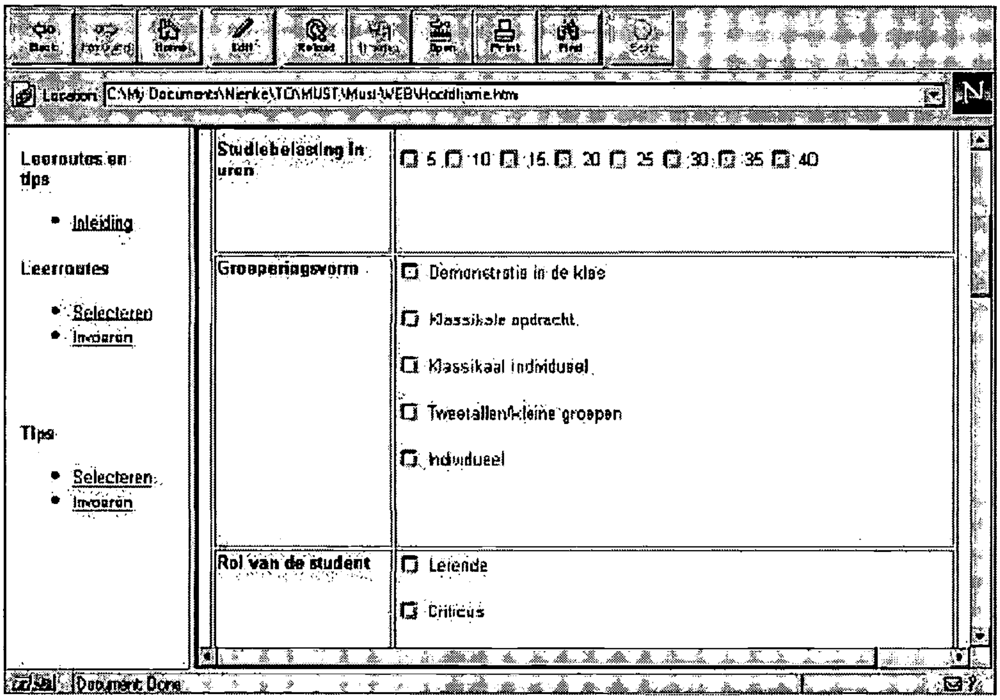

Figure 1: Sample screen of web-based selection tool

Teacher educators can also add their own learning routes, their experiences, and suggestions to the database. In this way, the database will start growing with new learning routes together with valuable experiences from practice. In other words, teacher educators will be able to share their experiences with one another. This may also further the discussion about the actual flexibility in use of MUST. In order to make knowledge sharing take place, teacher educators will first need to get acquainted with the Multimedia cases, and have experiences in using such cases in practice. It is assumed that the stages of concern in the adoption process of change by teachers (i.e., self, task, other), as identified by Hall and Loucks (1978), also apply to the introduction of MUST to teacher educators. Sharing information with colleague educators may come into focus when their attention shifts from "themselves" and "performing the task" towards their colleagues.

Conclusion

Engaging teacher educators in constructing, using and improving learning routes that support the effective use of the multimedia cases developed in the MUST-project, may support teacher educators in making explicit their own teaching philosophy and stimulate the discussion between teacher educators about the potential use of MUST.

The use of the World Wide Web gives teacher educators the opportunity to contribute to a learning community (cf. Liebermann 1996; Scardamelia & Bereiter 1996). In this case, teacher educators are perceived as learners with the use of WWW technology as a professional communication tool. These experiences may also be supportive when they invite their students to use the WWW as a means to build a learning community.

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Virtuality and Digital Nomadism in Teacher Education — the LIVE Project

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Abstract:
This article is based on the first-year results of a three-year R&D project called LIVE (Learning in a Virtual School Environment), 1997-2000, intended to develop new didactic networking models in virtual school environments with a special emphasis on mobile communication. This is performed by increasing the possibilities for co-operative and experiential learning in teacher education and by using MICT in open and flexible learning environments effectively.

To carry out the research, a three-level development model has been built, including the research group, the development group of the teacher trainers and the group of student teachers and pupils. In the collaborative action research model, the research group tries actively to influence the developmental processes of the teacher trainers' own work. The main result so far is that the learning of student teachers and pupils should be based on similar pedagogical experiences to the those of the development group in order to make an impact on teaching and learning practices. In addition, new pedagogical applications have been created, considering and predicting how teacher education could respond to the rapid development of MICT.

Keywords: co-operative learning, open and flexible learning environment, mobile communication, teacher education, teacher's professional development

Introduction

This article describes and analyses a research and development project called LIVE (Learning in a Virtual School Environment), whose aim is to develop new didactic models for virtual school environments. The project is being carried out at the Media Education Centre of the Department of Teacher Education at the University of Helsinki. Its didactic views are based on the concepts of constructivist and co-operative learning in flexible learning environments (For a detailed analysis of these concepts and other related theoretical points, see Nummi, Rönkä & Sariola 1998, http://www.helsinki.fi/kasv/media/projects/live/live.html) The didactic models of the project stress the importance of the skills which are needed in group work, communication and information management and which are essential in the learning environment created or supported by modern information and communication technologies (MICT).

Aims

The general aim of the LIVE project is to develop teaching and learning practices in a virtual school environment with a special view to mobile communication. This is carried out by increasing the possibilities for cooperative and experiential learning in teacher education and by effectively using modern information and communication technologies in open and flexible learning environments. A specific aim of the project is to

investigate the possibilities of increasing openness and flexibility in the learning situations from the viewpoints, of both the learner and the teacher. This is motivated, among other things, by the development of teacher education in the direction of ODL (open and distance learning) (Tella 1997).

In addition to developing the skills mentioned in the Finnish national strategy of education, training and research in the information society (cf. http://www.minedu.fi/infostrategy.html), the LIVE project also deals with the metacognitive planning and assessment skills of pupils and teachers. Furthermore, it is anticipated that the networking models developed in the LIVE project will offer schools an alternative solution how to implement their strategies. A long-term goal is to develop a model for the whole school how to work co-operatively when supported by MICT.

Research Tasks and Areas

The main research task is focused on describing and developing the didactic networking models of the virtual school. In this task it is assumed that through teacher education it is possible to change teaching, and furthermore that such changes can have a direct or indirect effect on the learner's learning process. The theoretical background is based on changing the learning conceptions of both the teacher and the learner from behaviorist conceptions towards constructivist ones. With regard to the learning environment, this means the promotion of open and flexible learning situations. Thus one challenging task of teacher education is to create didactic working models in which various elements of the open learning environment can be implemented. In addition to openness and flexibility, the dimension of social learning is taken into account in the form of co-operative learning. Team-working models are applied to the MICT-based learning environment for the purpose of creating teaching models applicable to teacher education. Based on the general and specific aims of the project, the main research areas of the project will be reflected on the basis of some cases during the first year (see the whole research design in Nummi, Rönkä & Sariola 1998, http://www.helsinki.fi/kasv/media/projects/live/live.html) The cases have been collected inside a teacher educational development model, described later.

The main research areas are:

A. The development of open and flexible learning environments in teacher education
B. The development of virtual school working methods and models
C. Changing teachers' professional working and their learning conception
D. Developing the use of modern information and communication technologies in open and flexible learning environments

Development Model

To carry out the research, a three-level development model has been built, including the research group, the development group of the teacher trainers and the group of student teachers and pupils (Fig. 1). In the collaborative action research model, the research group tries actively to influence the developmental processes of

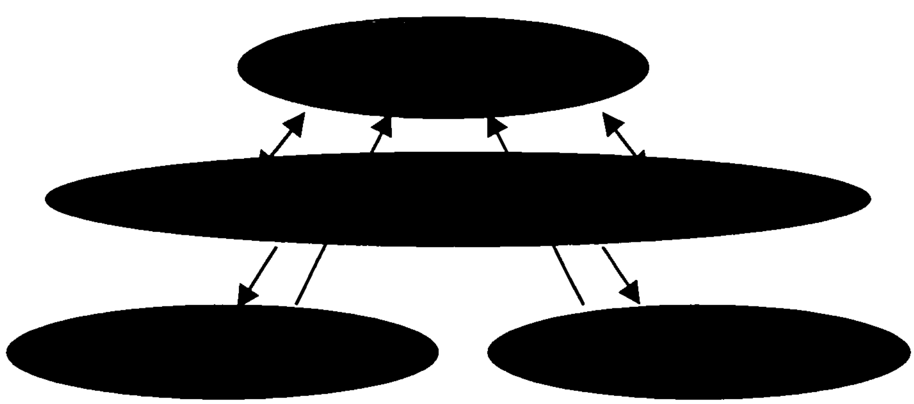

Figure 1: Three-level development model of teacher education in the LIVE project

the teacher trainers' own work. In teams, the teacher trainers have planned mobile and flexible learning projects, suitable for their own teaching and the tutoring of student teachers. The planning has been based on teachers' real pedagogical interests of development and theoretical self-reflections of teaching and learning. The members of the development group have applied the theories of problem-based and co-operative learning to their projects. In the development model, the research group has tried to support the professional development of the teacher trainers and to influence both the tutoring practices in teacher training and the teaching and learning practices in classrooms.

Cases

The first-year results of the LIVE project have been collected by interviews and observations of the development group and by case descriptions of teaching projects. In the following cases, the working methods and practices employed during the project and the experiences of teacher trainers, teacher students and pupils are described. The working methods and practices are called LIVE working models (cf. Nummi, Rönkä & Sariola 1998). These working models have consist of three levels, of which two have were tested and the third one will be described as a future vision.

LEVEL I: LIVE-Groups in Action
In one of the first level cases a LIVE group visited the local newspaper editorial office (Fig. 2). Their aim was to obtain expert information. In some cases the questions were inaccurate and the local group at school had to ask the editors clarifying questions.

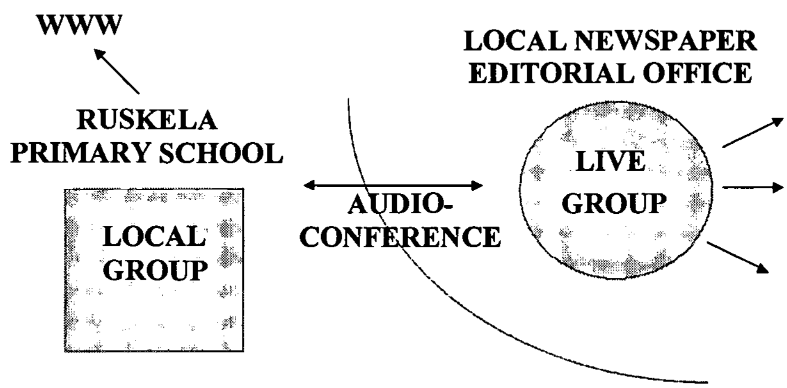

Figure 2: LIVE level I in practice.

The role of the local group at school was especially active. In this way the LIVE working model as a symbiosis of virtual and physical school promotes the integration of schools and the surrounding society. Experts from various fields can take part telematically in the activities of the school, which creates a competent discussion and innovation forum to satisfy the needs of the pupils, teachers and the whole learning process (Tella 1995).

A couple of LIVE experiments were conducted in connection with school trips at the secondary school level of the Second Teacher Training School of the University of Helsinki. For example, a class of 9th-grade pupils made a trip to Stockholm, Sweden, which included a few days' stay in a Swedish partner school and visits to places of interest in and around Stockholm. The LIVE action included sending faxes or e-mail and making phone calls between the LIVE group and the 8th graders. The 9th graders reported about their trip to school by fax or e-mail and the messages were put on a class noticeboard in Helsinki. At the end of the week, there was a half-hour real-time audio conference in Swedish between the pupils in Helsinki and in Stockholm with the purpose of sharing experiences and information collected during the week. The whole class in Helsinki participated in the audio conference by using a conference phone.

To sum up the experiences of these trips, the co-operative planning phase seemed to be important for the success of the LIVE action. With good co-operative planning and working, pupils can be actively involved so that

everybody can work according to the goals which have been agreed on together. Versatile communication by using the different possibilities of mobile telecommunications can take place in both real-time and time-independent interaction. To enhance experiential learning, the possibilities for live discussions, interviews or reports by using the Communicator can be used effectively. It is also important to organize the activities so that both local and LIVE groups can be actively involved with them. And finally, the analysis of the results and the evaluation of the activity should take place at both individual and group levels, including self-assessment.

Level II: Networking between Schools

As a more networked model, Level II lent itself to a comparison of subject contents. An extension from a local learning environment with the help of MICT to a more global environment provided new experiences. According to Tella (1995) a learning environment employing telematics is characterized by expanding means of influence and communication, shared resources and possibilities of exchanging ideas and negotiation, etc. (Tella 1995)

Testing of level II mainly involved a comparison of local sources of livelihoods and local histories between Kilpisjärvi School (located in northwestern Lapland, 1,200 km north of Helsinki) and Ruskela Primary School in southern Finland. While focusing on history, the pupils planned interview questions for the LIVE session. This took place through virtual co-operation. Audio- and videoconferencing were mostly used during teleteam-planning. By teleteams we mean a group of people working together with the aid of MICT.In the LIVE session, the LIVE group met the oldest inhabitant of Kilpisjärvi village, while the Ruskela LIVE group visited the local museum of history. In this kind of context real-time information was available from authentic primary sources. Pupils had a chance to visit virtually places they could not otherwise. One of the pupils from Kilpisjärvi, 1,200 km away, wrote in a self-evaluation report that "the most interesting and enjoyable thing today was when I *visited* (emphasis added) the museum of Ruskela". The differences between livelihoods were examined by becoming acquainted with a cattle farm and a reindeer farm. The LIVE groups communicated with each another via audio conferencing and fax in real life situations, while the local groups were looking for background information through videoconferencing.

The LIVE level II is an example of the pedagogical networking, which means intentional activity based on physical network and social networking. (cf. Nummi & Ristola 1998). The starting-point for the pedagogical networking is the teachers' real interest and willingness to co-operate using the existing media.

LEVEL III: Digital Team Portfolio in a Mobile Learning Environment

The following case is a description of the development work in the LIVE project focusing on new pedagogical applications for future teacher education in a mobile learning environment At the third level of live working, compared with the earlier levels, various forms of multimedia are increasingly used in communication. The case focuses on the development of a digital team portfolio. The aim of the project is to develop new resources and tools for network based tutoring and evaluation for teacher education. A special emphasis is on finding new possibilities to exploit digital team portfolio as part of the tutoring process in teacher training practice.

A digital team portfolio is a tool for self-evaluation and assessment. The team portfolio process consists of several stages. Student teachers start it by creating their own network, a teleteam. After networking they collect all available material concerning their practice period. Out of that information storage, they select the material that has affected their pedagogical thinking and reflect on it. In the following stages students are connected to each other sharing their experiences and presenting their digital portfolios to other members of the teleteam. Students further develop their working by perfecting the digital portfolio on the basis of teleteams feedback. From the viewpoint of teacher trainer the portfolio process aims to make students' professional development visible and support the processes of their pedagogical thinking. The role of the teleteam is to form a mirror for students' pedagogical thinking in networks. The use of this kind of digital portfolio as a part of teacher training practice requires teacher trainers to have good command on various team tutoring models and pedagogical networking models.

The latest portable communication tools with multimedia facilities enables to save, edit and present learning material also in mobile learning environments. These integrated mobile communicators form a telematic bridge between school and the outside reality. They also give teacher students new possibilities to process into a digital form all the material they produce during their teacher training.

Findings of the First Year

Based on the first year experiences of the LIVE project three aspects emerged. First, it seemed obvious that planning should be emphasized. Especially the didactic media planning facilitated open and flexible learning. Didactic media planning emphasized the importance of co-operative planning and also the appropriate use of modern information and communication technologies as tools to deepen the quality of contents. Secondly, it seemed essential to plan carefully which communication channel would support the goals of the learning process best. There were several channels to mediate interaction: audio conferencing, video conferencing, fax, the Internet and e-mail. Thirdly, the pupils' cooperative and social skills developed in the LIVE working cases. They created their own codes of responding and answering. Thus, it could be argued that the role of the virtual school teacher will be emphasized in the introductory and in the evaluation session. During the process the teacher's role will tend to be rather one of providing support. The pupils' metacognitive skills developed through the formulation and asking of questions, using descriptive language and expressing themselves accurately. Thus modern information handling and communication skills are needed when learning takes place in an open and flexible learning environment.

> "I started to plan the learning environment with the pupils' openness and activity on my mind. Based on the reports and discussions, I saw the pupils' MICT education as a key concept. ... It was amazing how the roles of pupils changed. The control of the learning situation moved strongly towards pupils when responsibility and tools (=skills, knowledge and technologies) were given to them."(Translated statement of a student teacher)

The use of communications technology seemed very natural to pupils. They learned to send faxes, e-mail and short messages. However, the most common way of using the technology was audio conferencing, which stressed the importance of co-operational and communicational skills.

When it comes to the teacher trainers in the development group, they regarded the support of their professional development as significant both theoretically and practically. The main result so far, however, is the fact that the learning of student teachers and pupils should be based on similar pedagogical solutions and experiences to what the activities and experiences are in the development group in order to have a strong effect on the teaching and learning practices. From the perspective of teacher training, this means that the new co-operative, student-centered teaching and learning practices, if experienced by the students and the teacher trainers alike, will be transferred more easily to schools by the student teachers. It has been important for the teacher trainers to be able to choose their own aims of professional development. On the other hand, the development of teacher's work has proved to be a slow process in which a year-long co-operative training period only gave the first steps in the direction of open and flexible learning.

Visions for the Future of Teacher Education

How should the study environment created by teacher education change if all the information in the world were to be available in the student's pocket? The wildest visions of the development of information and communication technologies can already be read in the advertisement brochures of large telecommunications companies. Whether we like it or not, it is the market which takes care of the sale of the latest telematic equipment. It is therefore worth considering how teacher education could respond to this rapid technical development from the perspective of media education and educational research. In the following vision we are reflecting pedagogically McClellands (1997) ideas about some technical solutions of tomorrow and their possible impact on teacher education and teachers' work in an open learning environment. (cf. Sariola 1998)

• Hardware and equipment will become smaller
From the point of view of the planning of teaching, this means the portability of equipment, and also student group mobility from one place to another carrying portable media with them; the increase of independence of place will have an impact on the shift of the control of study from teacher to pupil.

• The use of wideband channel technology
The latest wideband channel technology enables the simultaneous use of, for instance, the telephone and electronic mail within the same mobile phone. In study situations students communicate simultaneously through

several media, for example the fax, electronic mail, or video or audio conferences. Here teachers and pupils need knowledge about the bases of media choice and the characteristics of each medium. It can be presumed that the use of several communication channels enhances interaction between pupils.

• The growth of data transfer rate

The use of a faster data transfer rate in integrated mobile media will open up new possibilities for using portable video conference for different subjects. The ability to watch and comment on images presented directly from nature in real time expands the borders of the physical school in the direction of the virtual school. The increase in data transfer speed will also enable the use of multimedia characteristics in study. The use of still images, video images, sound and hypertext requires the skill to plan interactive material from both teacher and student.

The key factors of change affecting the technical and pedagogic visions presented above are the Internet and mobility. From the point of view of teacher education, however, the most interesting aspect is their joint effect on study and learning. One possibility is the strongly increasing use of digital portfolios, which will also lead to new changes in our evaluation culture. On the other hand, digital nomadisation tells about the student's metaskills, such as planning and evaluation skills. These kinds of skills include obtaining and managing information, and communication skills. Even though the description of technical development, as cited above, provides plenty of ideas for the planning of an open learning environment, in teacher education we have to return to the basic question of how the student can become aware of and develop his or her own way of planning teaching. The combining of research and development in student supervision will become the criteria of high-quality teacher education. The latest research information within the field of media education and the goals of education will become visible in the student's portable portfolios as multimedia productions.

The next year of the project will more deeply focus on the interaction of school and the surrounding reality using the possibilities of mobile flexible learning and a virtual learning environment in the teacher trainer's work. A special aim is to develop tutoring models of network-based teamwork where learning processes are assessed with the help of digital team portfolios. This leads to the question: Is the future of teacher education in digital nomadism?

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Restructuring Preservice Teacher Instructional Media Courses

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Abstract: This paper describes one university's efforts in migrating an undergraduate Instructional Media course from a traditional stand and deliver model to a web-based electronic classroom. A rationale includes the background for the decision making move and a description of similarities and differences of both delivery methods. A transformative approach focuses on user-centered design placing preservice teachers in the center of their own learning. Instructional technologies are presented within the framework of cognitive learning and reflective thinking is highlighted. Discussions examine the challenges of creating a student-centered learning environment for a majority of students and faculty embedded in traditional teaching methodology. This model features assignment modifications, physical delivery revisions, electronic communication components, time commitment and educational materials. A dialogue concerning the obstacles and victories experienced by faculty and preservice teachers (while moving a course of this nature to the web) is provided. The paper concludes with summations and recommendations for similar undertakings.

Introduction

"New prophets of hyperreality...argue that the computer is the final road to human freedom because it permits each of us to create our own worlds, to escape the straightjacket of linear text, to make thought a collage of insight" (Aronowitz & Giroux, 1991; p. 192; Burke, 1996). Researchers find today's students have shorter attention spans, are less able to reason analytically, to express ideas verbally, and to attend to complex problems. America's increasingly fast-paced lifestyles, paired with a bombastic media offering immediate visual gratification, is generating students who are characteristically nonconformist toward traditional modes of academic learning (Healy, 1996). Furthermore their exposure to computer programs and TV editing techniques tend to compress, extend, and distort normal time-space relationships, becomes a critically important element in learning (Sylwester, 1997). "The result of technology literate students and an antiquated educational system is...a growing educational 'crisis' of malcontent between [students] and their instruction" (Fulton, 1995).

Students of today and tomorrow will arrive in classrooms with new skills and needs (Kennedy, 1996; Fulton, 1998). "Denying a student easy and extensive exploration of electronic technology helps to create an electronically hampered adult in an increasingly electronic culture" (Sylwester, 1997). Students who also learn to effectively assimilate, reflect and question what they experience are better equipped to prevail in our exponentially accelerating cyber lifestyle.

Our post-secondary educational institutions, modeled on an industrial age assembly line approach, facilitated by 19th century educational technologies, where students remain stationary receptors and information comes to them in prefabricated orchestrated units, is no longer pedagogically sufficient. A

creative effort is needed to switch "the educational process from package to discovery..." (McLuhan & Fiore, 1967, p. 101).

Paolo Freire's *Influential Pedagogy of the Oppressed* establishes a theoretical starting point for rethinking "teacher-centered teaching and in favor of student-centered teaching". This transformative approach places students in the center of their own learning while fostering higher-order thinking skills such as synthesizing and integrating information, problem solving and taking responsibility for their own learning (Freire in Gallop, 1995, p.66; Aronowitz & Giroux, 1991, p. 15; Miliken, 1997). What was once considered an appropriate pedagogy for decades, when teachers were ordained reliquaries and dispensers of knowledge and "teaching was telling and learning was memorizing" (Fulton, 1998), is no longer applicable. Our preservice teacher educational system needs to come to terms with the needs of a new generation of students who are entering into a new millennium-ten decades promising access to technologies which were once contemplated as fantasy.

Preparation of preservice teachers to use and integrate technology into their own future classrooms must be pursued. The National Council for Accreditation of Teacher Education (NCATE) reports:

> Classroom teachers hold the key to the effective use of technology to improve learning.... The nation's teacher educational institutions must close the teaching and learning gap between where we are now and where we need to be.... Teacher education institutions must prepare their students to teach in tomorrow's classrooms... (Cooper, 1997).

Northwest Educational Technology Consortium (NETC) concurs:

> Rather than wait to see what tomorrow's classrooms will be like, [preservice educational institutions] must experiment with the effective application of computer technology for teaching and learning in their own campus practice. Today's teacher candidates will teach tomorrow as they are taught today (Queitzsch, 1997).

The Study

Several months ago, The University of Montana School of Education readily embarked on a project to change the content and approach toward teaching the required preservice teachers' one credit instructional media course entitled *C&I 306: Instructional Media and Computer Applications* (Robinson, Brewer, & Erickson, 1998). By placing course content on a web server, we both modeled and encouraged preservice teachers to learn via non-traditional educational technology. "Without appropriate modeling of integration of technology into coursework, future teachers cannot be expected to develop desired skills" (Jinkerson, 1995). Our overall goal in this class was three-fold: 1) to encourage preservice teachers to become educational technology advocates by creatively implementing appropriate educational technology within the walls of their K-12 classrooms; 2) to develop preservice teachers' critical and reflective skills in assessing the power of different media for expression and learning; 3) to nurture and grow as educators (as lifelong learners) with a heightened awareness for the potential of technology as an effective learning tool.

This course was designed to familiarize education majors with a variety of non-print media resources available for supporting K-12 instructional design. Computer technology (including multimedia presentations, educational computer software, telecommunications (including use of the Internet, browsers and the World Wide Web), and other technologies for preparation of curriculum enhancing instructional materials were integrated into the syllabus.

Since engaging the student in the learning process is the keystone to a solid beginning, we placed a primary focus on using educational technologies that most effectively enhance the teaching and learning process. Without the ability to incorporate electronic media into their professional curriculum design and classroom management, preservice teachers will not have the aptitude to make informed choices regarding essential educational tools (Caine & Caine, 1994). To this end, we used the *International Society of Technnology in Education (ISTE) Recommended Foundations in Technology for All Teachers* (1998) and the *U.S. Department of Education Priorities: Major New Initiatives for Fiscal Year 1999* (1998) as guides along with *The Big Six Skills Model of Information Problem-Solving* (Eisenberg & Berkowitz, 1998). C&I 306: Instructional Media and Computer Applications serves as a step toward preparing preservice teachers for the real world-the information age paradigm.

Traditional and Pilot Course Similarities

Course assignments sequentially build on one another in a scaffolding mode. The overall purpose of each project is to explore how to adapt media for classroom instruction which are responsive to each student's area of educational certification. Instructional strategies are based on assisting individuals in overcoming any underlying fear of working outside comfort zones and predetermined technology bias (Cooper, 1995; Kortecamp & Croninger, 1995; Kovalchick, Millman, & Hrabe, 1998). Students, while developing the skills and strategies appropriate to the use of educational technology, will be able to: a) demonstrate the basic operations of educational technology tools including camcorders, VCRs, CD-ROMs, laser discs, copying machines, televisions, projectors, etc. and the ability to explain these operations to others; b) select, evaluate, and use instructional software and other developmentally appropriate materials and resources appropriate to his/her area of specialization; c) become aware of a variety of telecommunications resources and techniques for retrieving, analyzing, interpreting, evaluating, synthesizing and communicating information and ideas; d) become familiar with the various aspects of instructional design and apply them to the production of instructional materials; e) create instructional software and multimedia presentations for use at suitable grade levels and subject areas; and f) communicate electronically with colleagues.

Both classes used extensive corresponding syllabi. Differences were minor. A chronology of Assignment descriptions, due dates, significant adjunct URLs and project evaluation criteria were outlined. E-mail reflective journals and inquiry communications were an integral part of the curriculum. "In many technology classes, students are reluctant to ask questions during class because they are embarrassed or feel that they are the only ones experiencing problems. E-journals provide a safe way to ask questions, converse with, and offer suggestions to instructors about the class" (Kovalchick, Millman, & Hrabe, 1998). Carefully composed step-by-step guides directed each phase of instruction. Equipment included Windows-based and Macintosh computers connected to the Internet and the following peripheral devices: flatbed scanner, videocassette recorder, camcorder, laser disc player, audio disc player, QuickTake camera. Additionally, over 200 instructional software programs were available via The University of Montana Teacher Resource Center. Available software guided students through an evaluation process used to determine appropriate educational software within the perimeters of instructional design.

> Projects included individual and cooperative group environments keyed into lesson planning. The defining characteristic of technological knowledge, however, is its relationship to activity. Although technological knowledge is considered to have its own abstract concepts, theories, and rules, as well as it's own structure and dynamics of change, these are essentially applications to real situations (Herschbach, 1995, p. 33).

Students have limited access to lab equipment outside of scheduled class activities. Unless they had the software programs on their own personal computer, lab time was a problem. E-mail and Internet access can be accomplished from any campus computer site but current software programs and required hardware are not readily available.

Overall, students' technical knowledge in both the web-based and the traditional paper-based course were comparable. Prerequisites included either a three-credit computer science course (CS 171: Communicating Via Computers) or a three-credit business education course (BITE 183: Integrated Software Applications and Multimedia). A few students in each section somehow bypassed the prerequisite and took the course simultaneously with either CS 171 or BITE 183. Student experience ranged from limited computer proficiency to basic word processing and presentation software skills. Most were somewhat familiar with some application of the Internet and had previously established e-mail accounts.

Traditional and Pilot Course Differences

Traditional Classroom

The traditional course, composed of 22 students, was taught in the spring semester of 1998. Students met in the Educational Technology Lab for two hours once a week for sixteen weeks. Teaching C&I 306 via the traditional classroom model ran into many obstacles. Even though both traditional and pilot courses endorsed the importance and advantages of incorporating educational technology into classrooms, the traditionally taught course lacked modeling especially when it was facilitated with a weekly barrage of paper-based assignment information. Students were inundated with copying machine-generated information

including syllabus, assignment calendar and much needed step-by-step technical information. Students often misplaced "hand outs" or forgot to bring them to class. Absent students relied on others for copying assignment information or arranged to pick up the printed information before class meetings. Extra copies were generated to supply these demands.

In addition, students lacking a technology comfort level and those too shy to ask questions were perpetually in catch-up mode. Note-taking often hindered their attention to hands-on instruction. Misinformation was common. E-mail journals reflected their frustration. Many instructor hours outside of the classroom were spent e-mailing assignment clarification to students. For example, one student e-mail reflected:

> I have concerns about catching on to what is presented in class when there are so many of us and so few of you...I only got to step seven on the *Searching and Saving For Multimedia Presentations* activity this week in class.

Another student e-mailed:

> What should be done with the pink handout titled *Navigator Quick Reference Guide*? It appears to be directions for an assignment. I did run into problems interpreting *The Use of Copyrighted Works: A Crucial Element in Education America* by Brinson and Radcliffe because their article had a different title [than the title given out in class] so I was looking and looking for another article by them but figured out it must have been the first one I had bookmarked.

Pilot Web-Enhanced Classroom

The web-enhanced pilot course, composed of 17 students, was taught in the summer semester of 1998. Students met in the Educational Technology Lab for three hours four times a week for three weeks.

C&I 306.08 was designed as a paperless course. All syllabus, assignment descriptions, due dates, significant URLs, tutorials and project evaluation criteria were available online. Students were literally a mouse click away from accessing information any time of day or night from any on or off campus computer terminal with Internet access. Course designers, taking a cue from Robert Sylwester's work, anticipated that the physical interaction in a technology-produced environment would establish an understanding of its limitations and potential (1995, p. 65).

Using educational technology to teach an educational technology course serves as a strong model to preservice teachers. Students experienced first hand, the convenience, consistency and challenges of implementing electronic technology as a primary information source. As Postman and Weingartner (1969) state, "When you plug something into the wall, someone is getting plugged into you. Which means you need new patterns of defense, perception, understanding, and evaluation. You need a new kind of education" (p. 7).

The original intent of C&I 306 was a "hands-on" curricula blossomed-product taking a back seat to understanding process. In this project-oriented, cooperative learning paradigm, students took responsibility for their own instruction.

Lab time was much more productive than the previous semester. In this nonlinear approach, many tasks were going on at any given time. Little confusion about assignments surfaced. Hyperlinks embedded into the course became an important characteristic toward student empowerment. Those students who could work ahead did so with the web-based information readily available online. Those students who needed additional tutoring could do so with links to Internet sites designed for that very purpose. Required readings were linked into the web pages so that even a "browsing" novice could easily access (without undue frustration) significant URLs. One C&I 306.80 student reflected:

> I can understand why technology has not spread in the schools like it has in our world. Teachers are just beginning to receive the information that is needed to understand computers and all of the work that they can do. Veteran teachers that are out in the field now definitely have not received the training that I am gaining from this class. Unless these veteran teachers have gone out and gained training on their own they are creating a disadvantage for their students. When ignorance towards technology is leading the students of our country then problems occur... Children are going to pick up computer knowledge so much faster than adults do and we need to constantly catch up with them. The only disadvantages that I can see with computers is the fact that they are supposed to save time but with the initial shock I see the reverse... I have just begun to realize that computers can *REALLY* save me time. I never believed anyone when they told me before.

Conclusion and Recommendations

Conclusions

This model appears to have great possibility as a means of delivering the Instructional Media Course. It accommodates classes in which students enter with a variety of technology skills. Students can work at their own pace any time of the day or night. Students can use the platform of their choice for most of their projects. Students who live far away from main campus can take this course provided that they have access to the appropriate equipment and software. This same flexibility allows faculty to communicate with their students from almost any place in the world. It also lends to greater interaction between faculty and students, as faculty virtually is accessible as many hours a day as they have their computers on. Continuous monitoring student feedback and increased student technology literacy offers an invaluable catalyst for developing this type of course.

Recommendations

1. Faculty members who teach web-enhanced courses should plan to spend many hours online. Contrary to popular belief, moving to web-based courses increases preparation time and student contact time.
2. Lab monitors should be well versed in using both hardware and software required for the course. Nothing frustrates students more than encountering a lab monitor who can not answer their questions in a straight forward timely manner.
3. Plan to schedule as many open lab hours as possible. Many students still do not have computer access in their place of residence. Even if a student has a computer at home, they may not have the appropriate software or peripheral devices.
4. Doggedly monitor the working status of technology used in the course. Keeping the equipment in top working order is a priority. Nonproductive time spent on equipment that does not work turns off even the most seasoned students.
5. Anticipate student frustration in the beginning of a mediated learning environment. Many students are more accustomed to graded "correct" learning outcomes (Caine & Caine, 1994, p. 85).
6. Design a logically navigated website. Not being able to access information in a direct manner via mapping and hyperlinks quickly frustrates students and, in turn, the instructor.
7. Transition your instructing role to more of a facilitator than a lecturer and enjoy the changes this will produce in your course.

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DEVELOPING AN INTERACTIVE MULTIMEDIA NETWORK FOR RECRUTIMENT, RETENTION, AND REJUVENATION OF TEACHERS

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Abstract: This paper describes the development of a project funded by the U.S. Department of Commerce which is designed to contribute to educational reform by exposing teachers in 124 rural schools to the latest research and methods for improving instructional effectiveness. The project employs a variety of digital and video technologies to deliver content developed by the faculty of the USC Aiken School of Education via distance education. Teachers and prospective teachers in these rural schools will use these technologies to access web-based lessons and tutorials, select video demonstrations of classroom techniques and effective teaching, select CD-ROMs, participate in video conferences, maintain their state certification, consult with professors of education, and interact with each other.

INTRODUCTION

Tremendous gains have been made in education in South Carolina, but its students consistently rank low when compared to those of other states. This is especially true in rural areas, where communities face a number of cultural, technical, and societal barriers as they strive to educate their children for success in an increasingly complex world.

Foremost among the barriers faced by rural school districts are difficulties in recruiting, retaining, and rejuvenating teachers. In a survey of rural school districts conducted last year by the South Carolina Association for Rural Education, "retention, recruitment, and training of teachers" was listed as the number two concern, following equity of funding.

There are 14 school districts in the southwestern South Carolina counties that are the subject of this proposal. These districts contain 124 schools. Sixty-eight of these schools have been identified by the South Carolina State Board of Education as rural schools facing great difficulty in recruiting teachers. One solution the state has implemented is forgiving the student loans of teachers who remain employed in these schools for five years.

Once recruited, however, teachers in remote and rural areas often do not have access to the same professional support and advanced technology available to teachers in wealthier and more populated areas of the state. This is due to their physical isolation from sources of support and training, and the lack of state and local funding to pay for such services. This inequity contributes to feelings of frustration, leading to decisions by rural teachers to relocate to more populated areas, or to leave the profession.

In order for students in rural areas to participate in classroom experiences that prepare them for higher education or a place in an economy that is increasingly driven by technology, it is imperative that their teachers receive continual and affordable training that keeps them effective in the rural classroom setting. Such support will improve learning by their students, help make prospective teachers more willing to undertake the challenges of teaching in rural schools, increase the willingness of teachers to remain employed in rural schools, and will rejuvenate long-time teachers in rural areas.

THE PROJECT

This project will help rural schools surmount these obstacles by establishing the Rural Alliance for Teaching Enhancement (RATE). This interactive multimedia network will deliver support to 14 school districts in southwestern South Carolina. This support will help in their efforts to recruit, retain, and rejuvenate teachers in rural schools.

Content developed by the School of Education at the University of South Carolina Aiken (USCA) will be delivered through a network that involves schools in McCormick, Edgefield, Aiken, Barnwell, Bamberg, Allendale, Hampton, Colleton, Jasper, and Beaufort counties, and rurally located branch campuses of the University of South Carolina in the towns of Walterboro, Beaufort, and Allendale.

RATE will employ a variety of digital and video technologies, including Internet applications such as email, listserves, discussion forums, World Wide Web-based learning tools, video conferencing, streaming multimedia, and instructional CD-ROMs and video tapes produced at the School of Education at USCA.

Teachers and prospective teachers will use this technology to: access lessons and tutorials about effective teaching methods; select video demonstrations of classroom techniques and examples of effective teaching; select CD-ROMS of the same material; participate in video conferences on teaching in rural schools; maintain their state certification through university-level coursework; interact with each other; and consult with professors of education at USCA and the University of South Carolina branch campuses in Beaufort, Allendale, and Walterboro.

While RATE will focus on using advanced telecommunications and information technologies in the recruitment, retention, and renewal of teachers, eventually it may also offer content for parents and other community stakeholders, such as video conferences aimed at increasing involvement in the educational process in rural areas.

This solution will make a difference to students in rural communities by exposing their teachers to the latest knowledge and research for improving instructional effectiveness, as well as demonstrations of how teaching in rural areas can be enhanced. This will increase learning by rural students and improve their opportunities for employment and higher education.

Outcomes

We expect a number of measurable outcomes from this effort to assist rural schools in the recruitment, retention, and rejuvenation of teachers.

- More students from rural areas will choose to be teachers and work in rural schools as a result of RATE's early identification and nurturing of prospective teachers from rural areas, and the use of this interactive, multimedia network in support of the state's ongoing Teacher Cadet Program for high school students.
- More novice teachers in rural schools will choose to remain in rural locations as a result of RATE's system of support and mentoring.
- Veteran teachers in rural schools will be rejuvenated as a result of RATE's capabilities, via digital and video technology, to present new instructional techniques and learning approaches designed to improve their effectiveness in rural classrooms.
- Teachers in rural schools will maintain their state certification by utilizing RATE-sponsored graduate course offerings via distance learning technologies.
- RATE will make advanced telecommunications and information technologies more available in rural school districts, thereby improving equity of access for teachers, prospective teachers, students and communities in rural areas of southwestern South Carolina.

Significance

The Rural Alliance for Teaching Enhancement is significant because it uses advanced telecommunications and information technology to make the resources of a university the catalyst for meeting primary needs of rural schools, and teachers in those schools. RATE's approach is innovative in ways that distinguish it from other projects aimed at improving education. Its focus is on providing services to teachers (rather than students) in rural areas in order to facilitate their recruitment and retention, and in order to improve their effectiveness in the classroom. This will positively impact rural students by providing much-needed support to the teachers charged with the responsibility of expanding their knowledge and improving their thinking skills.

Its organizational model is innovative in that it transcends the political boundaries of counties and school districts, making support available to all rural schools in southwestern South Carolina. This creates a unique partnership of rural communities connected by their common need to recruit, retain, and rejuvenate teachers. This organizational strategy and use of advanced technology will help rural teachers overcome the traditional geographical and financial barriers that have prevented their access to such services.

Rural schools in southwestern South Carolina are not unique in their struggle to recruit, retain, and rejuvenate teachers. RATE's approach is highly replicable in other rural areas of the United States, both in terms of its technical approach and its organizational model of forming an alliance among institutions of higher education, local school districts, and other relevant organizations and associations.

Project Feasibility

Teachers in rural schools will access RATE's content and support through Compressed Interactive Video, the Internet, CD-ROMS, or video tape. Most content will be accessible by any of these four methods of delivery, allowing users to move from one delivery method to the another according to their preference, depending on what end-user technology is available to them.

Compressed Interactive Video allows instructors and students to see and hear one another from distant sites. It allows users to converse, share immediate feedback, and display information such as computer program output, previously recorded video programs, and three-dimensional objects.

Internet technology such email, listserves, and discussion forums will foster communication among RATE's users. World Wide Web-based learning tools will be menu-driven and incorporate the latest in web communications, including streaming video. CD-ROM technology was chosen as a delivery method because the medium is stable and fairly widespread, and can convey a large amount of information. Another advantage is its allowing users to access information in a non-linear fashion tailored to their own needs and preferences. Video technology, though not cutting edge, was chosen because it offers information to the widest range of potential users due to readily available video cassette players in their schools and homes.

RATE's multiple delivery approach was chosen in order to deliver services to as many end users as possible, and to compensate for a lack of standard technology in rural areas. RATE's four delivery methods allow for timely implementation of its programs, and allow end users great flexibility. They take advantage of existing infrastructure and commercially available telecommunications services.

The project team is composed of highly-qualified, experienced faculty and staff who will serve as members of the RATE Team and oversee the operation and execution of the grant. Representative on the RATE Team have expertise in instructional technology, staff development, and pedagogy. The RATE Team will be coordinated by the Principal Investigator and Project Manager. A RATE Project Director will be employed and have responsibility for implementing the programmatic aspects of the project. A RATE Advisory Board composed of representatives from each of the 14 school districts will be established to advise the RATE Team.

Sustainability

This project establishes and enhances the infrastructure for continued recruitment, retention, and renewal of teachers in rural school districts. Having established a successful working model for the project, it will expand to include additional rural school districts in the region and will continue beyond the three-year funding period. Additional funding for continuing expenses will be solicited from private and other

entities with an interest in promoting the widespread use of advanced telecommunication and information technologies in the public sectors.

Involvement of the Community

As the concept of RATE was developed, information was shared with local stakeholders by telephone, email, and fax. Consultation with key participants in these widespread communities has been crucial in refining RATE's intended goals and methods. The formation of the RATE Advisory Board will ensure that its services are determined by the needs of the communities and it serves.

REDUCING DISPARITIES

Description and Documentation of the Disparities

According to the 1990 United States Census, an average of more than 65 percent of the population in the 14 school districts to be served by RATE are classified as Rural. Three of the districts (Hampton 2, Jasper, and McCormick) are 100 percent rural. The school district with the lowest percentage of the population classified as rural is Beaufort, with 32.7 percent. Even so, 12 of its 20 schools are classified as rural by the South Carolina State Board of Education. Because these schools are facing great difficulty in recruiting teachers, the student loans of teachers who remain employed in these schools for five years are paid by the state of South Carolina.

The average percentage of the population 20 years old or over with less than a 12th grade education in these districts is 38 percent, according to the 1990 U.S. Census.

In the 10 counties that contain the 14 school districts to be served by RATE, an average of 26 percent of the families with children age 17 and younger were below the poverty level in 1989, according to the 1990 Census.

In October 1995 the percentage of pupils eligible for free or reduced-price lunch in the 14 school districts RATE will serve averaged more than 68 percent. The median for South Carolina school districts is 55.7 percent.

These demographic and economic factors have a direct impact on school district finances, the quality of services districts are able provide to students, and the quality of support districts are able to provide to teachers.

For instance, during the 1995-1996 school year, the districts RATE would serve allocated an average of only $216 per teacher for in-service activities and training, according to statistics compiled by the South Carolina Department of Education. Three districts allocated less than $60 per teacher for training, including McCormick, which spent exactly nothing for this purpose.

This lack of funding creates disparities in the amount of advanced technology available in these districts, and hinders the ability of rural districts to recruit, retain, and rejuvenate teachers. This is an especially burdensome problem in the context of the statistics on poverty and education mentioned above.

Strategies for Overcoming Barriers to Access

By using advanced telecommunications and information technology, RATE will compensate for this lack of resources by providing inexpensive and continuous support to help increase the effectiveness of teachers in rural classrooms, and aid rural districts in the recruitment, retention, and rejuvenation of their teachers.

EVALUATION, DOCUMENTATION, AND DISSEMINATION

Evaluation Plan

A multi-method approach will be used to evaluate the three major goals of this project. With respect to recruitment and retention, baseline data will be obtained on teacher recruitment for 3-5 years preceding the anticipated start date of the project. A group of counties with equivalent demographics to the ten counties included in the project and which have no intervention programs directed at the same goals will be identified and will serve as a control group. At the completion of the project, the data for the years of the project will be compared within and between the two groups. Each projected activity will also be evaluated by user surveys. Process evaluation will also be undertaken through the use of focus groups and interviews, so that a fine-tuning of the process and a check on the usefulness of materials produced will occur. The goal of rejuvenation will be evaluated through focus groups, interviews, and survey instruments. An initial round of these assessments will establish a baseline against which the evaluations for each year of the grant and the total project can be quantitatively and qualitatively compared.

Documentation Plan

All evaluation instruments will be retained. As they are analyzed, executive summaries will be prepared. Conferences and presentations for the teachers will be recorded and each focus group summarized. Activities via the Internet will be archived on a project web page which can easily accessed and transmitted. Project management software will be used to track all activities and compare the actual versus anticipated time and resource allocations. All brochures, CD-ROMS, and videos produced will be cataloged and retained. Papers concerning the project presented at meetings also will be compiled.

Information Dissemination Plan

Dissemination will be primarily through the project's web page, which will provide examples of the materials produced (possibly some in their entirety), links to related material, and text of the project's description, goals, timelines, and insights. Presentations will be made at various conferences relevant to rural education, teacher training, and the use of multimedia resources in education.

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PORTRAYING MULTIPLE INSTRUCTIONAL PERSPECTIVES THROUGH CD-ROM TECHNOLOGY

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This session demonstrates an interactive, context sensitive learning tool, a CD-ROM, that is being used to improve instructional and leadership practices in rural, culturally diverse communities. The CD-ROM captures: (1) actual teaching episodes; (2) teachers' reflections about the "hows" and "whys" of their teaching strategies; and (3) video clips from university faculty, lead teacher liaisons, parents, and community members commenting about the teaching episodes. Instead of critiques of teaching, the CD-ROM provides multiple perspectives / reflections / interpretations, highlighting important issues such as those related to culture, instructional strategies, and curriculum. The non-linear, interactive approach allows users to access multiple levels of information, depending on their needs and interests. The content provides prospective and practicing teachers and administrators the opportunity to develop a better appreciation for the issues involved in rural, ethnically diverse communities than has been possible through books and library research.

PRESERVICE TEACHER EDUCATION

Something Old, Something New ...ISU

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Abstract: This session presents a model to develop skills for integrating technology into the curriculum for secondary pre-service teachers. An Independent Study Unit (ISU) is a vehicle that may be used to orient students' consideration of technology applications in the classroom. The ISU encourages student-centered learning, while requiring teachers to use a variety of soft and hard technologies to develop the unit.

Introduction

As computer technology continues to make greater impact on public school teachers and students, it becomes more important to develop new and/or refine older models of technology integration instruction. The process of preparing teachers to effectively use educational technologies must be continually re-assessed to order to meet changing needs. Courses designed to meet these needs range from Computer Literacy or Software Application skills to Methods or Technology Integration classes. Courses may be offered through Computer Science, Business, content disciplines, Educational Technology or other College of Education designated departments.

Technology needs for pre-service teacher education students include skills in all of these areas. One approach to meet these needs uses a process, "soft" technology, and integrates other process and product, "hard" technologies to develop it.

At a regional university, all students planning to meet state certification requirements for teaching secondary or middle school are required to take a 400 level course called Integrating Technology into the Middle/Secondary Curriculum. Presently, there are four sections offered each semester, with full class access to a computer lab with full-Internet access and e-mail privileges, and limited access to other instructional technologies such as overhead and opaque projectors, laminators, video cameras and recorders, laser disk players, scanners, digital cameras and computer projection systems.

Model

A new model called an Independent Study Unit (ISU) was developed derived from an older learning center concept. Learning centers are extensively utilized by elementary teachers, but middle and secondary teachers rarely (if ever) spend time on what is often perceived as "cut and paste" projects. As a result, secondary pre-service teachers have rarely been exposed to this type of a learner-driven instructional methodology. The ISU model is student-centered, requires active learner involvement and allows pre-service teachers to both experience and develop instruction using an alternative approach to direct instruction. It develops skills in instructional planning, materials selection and design, media selection and integration, and the use of the computer for presentation and productivity.

During the first weeks of the semester, students select a content topic around which they will develop a unit which extends or enriches primary instruction. The initial stage emphasizes a general systems approach to pre-planning and requires the pre-service teachers to analyze/describe the learners and environment, plan how and when the ISU will be accessed by the learners, and develop 2-4 main objectives/reasons for learners to interact with the ISU. The learner analysis allows pre-service teachers to begin to look at learners as individuals rather than as a "10th grade math class." Analyzing and describing the environment orients them to the importance of "knowing where you are and what you have to work with."

Further development requires the students to select or develop a variety of domain and level activities or materials that will enable learners to meet the unit objectives, and to plan and develop record keeping and evaluation procedures and materials. Project requirements specify that unit tasks must be appropriate for a variety of learners with content, application and extending activities with which their students will interact independently. The concept of independent content learning appears to one of the most difficult for the pre-service teachers to internalize. They find it hard to give up the role of deliverer of instruction. Evaluation procedures must include learner input on the unit as well as instructor assessment of unit components and learner achievement.

Throughout the semester, assignments are planned to enable the students to complete the ISU. Assignments develop skill in the use of old media (opaque, overhead, laminator and dry mount press), and new media (digital camera and full-page scanner). Computer application skills, taught in a required computer literacy class, are enhanced through assignments requiring specialized functions of a word processor, spreadsheet, electronic presentation and data base.

Required ISU objects and activities include:

- An interactive display which requires the use of the opaque to enlarge an object or picture.
- Learner directions (when (daily, weekly, etc.) and how (number and types of activities to be completed, etc.) to use the ISU)
- Information related to the location of supplies or work-in-progress
- Sample Record keeping form - learners and/or instructor
- Sample Evaluation (learner and/or unit and unit activities)
- Real object
- Eight activities must be identified from which student may learn new information, apply the new content, and extend what has been learned). The word processor, spreadsheet, and data base must be used to actually create at least 3 activities; other activities may be selected from commercial materials.
- A visual incorporating a scanned image. The image may be part of an activity or part of the interactive display
- Interactive PowerPoint to be used by learners as a content or application activity
- Incorporating an Internet site or the use of a piece of software

At the end of the semester, the completed projects are set up and displayed for all the sections of the class. All students are required to visit each exhibit and offer constructive comments. The comments are collected, typed up and returned to each unit creator.

The projects are evaluated on planning considerations of learner characteristics and activities, record keeping and evaluation techniques, quality of required products, inclusion of all components, and following directions.

Conclusions

The completed project represents an integration of hard technology (old and new media, and computers) and soft technology (learning centers, instructional design, alternative delivery methods, and cognitive and constructivist principles).

As more instructors implement web-based education, greater emphases are placed on constructivist approaches oriented toward learner independence and away from instructor delivered content. Much has been written or spoken about the changing roles of a classroom teacher; much has been tried at the college level to encourage pre-service teachers to re-direct classroom instruction. The fact remains that teachers translate and transfer that with which they are familiar, and for secondary pre-service teachers at the college level it is primarily direct instruction delivered through one-way lectures or text. This model provides a way for them to integrate process and product technologies in a constructivist oriented, learner centered manner.

Preparing Novice Teachers to Use Technology: Do They Practice What We Teach?

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Abstract: This study examined data gathered from novice teachers in an attempt to describe the effectiveness of the technology component of a preservice teacher education program. The paper describes the technological skills teachers transferred into their classrooms during the first year of teaching. The paper also discusses the technological skills and knowledge novice teachers found to be most useful in their teaching, as well as the skills they lacked. Findings of the study are presented, conclusions and implications are discussed, and suggestions are made as to how pre-service and inservice teacher education programs can be designed to more effectively prepare educators to integrate technology into curriculum planning and instruction.

Introduction

One can argue that the basic goals of American education have not changed appreciatively since colonial times. During this period (1620-1750), the primary aim of American education was reading, writing and computation. Reading and writing, in particular, were valued for the purpose of enabling students to read the Bible and, later in time, participate in a democratic society. This would ensure that children would be protected from the influence of the devil, thereby benefiting the entire commonwealth (Ornstein, & Levine, 1997).

Today, although the purposes of education are more secular, the principal aims of education remain consistent. Educators of the 20th Century have continued to view literacy competencies as a foundation for enabling students to participate more fully in society (Tompkins, 1997). Unlike colonial times, however, societal needs and expectations require students to develop literacy competencies beyond those of reading and writing (e.g., cultural literacy, scientific literacy, mathematical literacy, and computer literacy).

As we approach the new Millennium, school administrators, teachers, parents, and school boards acknowledge the need for students to become fluent users of technology. National and global trends have made a compelling case for the restructuring of the American educational system, which has been charged with preparing today's students to succeed in a high-tech, global environment. To achieve these expectations, national, state, and local agencies alike have charged teacher training institutions with the responsibility of equipping new educators with the expertise and skills needed to use technology in the classroom (Schrum & Dehoney, 1998; Blake, Holcombe, Foster, 1998; Myhre, 1998).

Although some consider the ability "to adapt to emerging technologies as a matter of survival" (Blake, Holcombe, Foster, 1998, p.40), evidence exists that teacher education programs have made insufficient progress in preparing graduates to use technology to enhance subject matter teaching (Schrum & Dehoney, 1998; Dell & Disdier, 1994). A study conducted by Criswell (1989) found that preservice teacher education programs failed to produce teachers who felt confident about using computers in their classrooms. To further

investigate this issue, the current study examined the effectiveness of a teacher education program in preparing first year teachers' to use technology in their classrooms.

The Study

In July, 1998, we conducted a study to examine first year teachers' use of instructional technology in the classroom. The purpose of the study was twofold: 1) to examine novice teachers' classroom applications of technology training received in their teacher education program, and 2) to determine attitudes and perceptions held about the effectiveness of their teacher education program in adequately preparing them to use technologies as teaching and learning tools. It was anticipated that information gained from the study would serve to identify needs as a basis for program changes to support novice teachers' successful integration of technology into curriculum planning and instruction.

Methodology and Data Analysis

A questionnaire was mailed to seventy teacher education graduates of Florida Southern College, who had just completed their first year of teaching. Twenty one teachers responded to the survey, which included questions to determine respondents' age, gender, grade level and subjects taught, and personal computer use. The survey also included questions designed to gather qualitative descriptions of classroom technology practices. Open-ended questions allowed for examination of the value of the junior level technology course required for all undergraduates in the teacher education program.

The course, conducted in a Macintosh Lab within the Education Department, was designed to examine the uses of instructional technology in the classroom. Special emphasis was given to developing computer literacy, including Apple basics, word processing, graphics, database, and spreadsheet. Use and evaluation of educational software were addressed. The uses of emerging technology, such as C-D ROM, videodisc, HyperCard, and HyperStudio were also included as part of the curriculum.

Results

The respondent group consisted of 20 females and one male, ranging in age from 23 to 44 years, with an average age of 23.5. Participants taught grades ranging from K-12, including 17 elementary teachers, one middle school teacher, and three high school teachers. Two of the four secondary teachers taught ESE classes, and two teachers taught English.

Of the 21 teachers surveyed, 20 reported having a home computer which they used on a regular basis mainly for the purposes of Internet browsing, email, and preparing materials and maintaining records for the classroom. Half of the teachers who had home computers used Macintosh machines, while the other half used IBM-type computers. Teachers reported using their home computers an average of 5 hours per week. Five teachers used their home machines for over 10 hours per week.

Of the 21 respondents, 18 reported having one or two computers in their classroom for student use. One teacher reported having four computers in the classroom. The types of classroom computers identified fell into three equal groups of Apple II, Macintosh, and IBM. The majority of teachers had students use classroom computers one student at a time. Two teachers had students work in pairs, and one teacher had students work in groups of three.

A strong majority of teachers identified the types of activities students engaged in while using the classroom computer were skill practice and/or educational games. Three teachers had students work on desktop publishing activities, and one teacher had students use the Internet for research. The average amount of time each student spent at classroom computers on a daily basis was 15 minutes.

When asked how computers or other technologies were used by teachers in the classroom to present lessons, no teachers reported use of computers and presentation software, or laser video disc technology. Only

two teachers reported that they used an overhead projector. Two said that they used a cassette player with tape on an occasional basis, and one teacher had used a filmstrip during the year.

When asked which skills learned in the teacher preparation technology class were applied in the classroom, seven teachers said none, six reported using educational software for skills practice, three used word processing, one created newsletters, and one used Print Shop. Only half of the respondents reported that they thought their undergraduate technology course adequately prepared them to effectively use technology in their classrooms. The most helpful part of the course was reported to be learning to use a Macintosh and integrated software (ClarisWorks). Exposure to educational software was seen as a plus, but teachers felt that even more exposure to educational software would have been beneficial.

The majority of teachers indicated the course was inadequate in preparing them for teaching for a number of reasons. They reported having insufficient preparation to effectively integrate computer technology into in classroom. Teachers were concerned that they had not learned to use the Internet to support instruction. They also reported a lack of knowledge to effectively manage computer use in the classroom (e.g., grouping students for instruction, scheduling computer use, and tracking students' use of computers, etc.). In addition, laser disk technology, HyperCard, and HyperStudio learned in the course were considered by respondents to be a waste of time because schools did not have the hardware or software to support these applications.

Conclusions and Implications

This study examined novice teachers' use of technology in their classrooms and their perceptions of the effectiveness of the technology training they received in their junior level technology course. The results of the study indicate that first year teachers were either not able to effectively apply their computer training to their teaching, or did not receive adequate training. Results of the study suggest that having only a single course in computer technology is insufficient to adequately prepare teachers to apply technology in their classroom. Further, if novice teachers are to successfully use technology as a teaching and learning tool, preservice teacher training must include instruction on the skills and knowledge needed for practical classroom use.

The results of this study illustrate the need for collaboration between teacher training institutions and schools. If novice teachers are to move beyond using computer drill and practice activities, teacher education programs must explore and develop more effective methods to ensure that new teachers will transfer relevant skills and knowledge into the classroom. Education faculty must stay abreast of not only which hardware and software is used in the schools, but how it is used by teachers to help ensure continuity between desired preservice and inservice practices. In addition, preservice technology curriculum must be continually assessed and modified to include emerging technologies and practices that will positively impact teaching and learning.

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A Model for Integrating Computer Support of Curriculum as a Teaching and Learning Tool

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Abstract: one major block to the effective integration of computer support of curriculum is not hardware and software, but preservice and inservice training of teachers. This paper reports on continued efforts at North Carolina A & T State University to overcome this problem by modifying and intensifying the computer instruction provided teacher education students. It also outlines work in partner schools in a collaborative process which provides university support of classroom teacher efforts to integrate computers into their curriculum.

One of the great challenges in American education is the current revolution in computers. The same technological advances schools are supposed to prepare students to use are not being utilized in the classrooms. Former U.S. Secretary of Education T. H. Bell (Bell & Elmquist, 1992) points out that U.S. teaching practices are outdated and that students and teachers need to be provided access to the same technological tools which have revolutionized American industry. He draws the analogy that "technologically, American education is wobbling down Electronic Avenue in an oxcart (p. 22)."

In its report to the U.S. Congress, the Office of Technology Assessment (1995) identified several impediments to the use of technology to support curriculum. The problem is not hardware or software, but technology education and technical support for student and professional teachers. Overall, school districts spend 55% of their technology budgets on hardware and 30% on software, but only 15% on education programs for the teachers. They report that inservice and preservice programs in technology focus on the mechanics of operating the equipment or running a program, rather than on integrating the technology into a specific curriculum or selecting appropriate software.

With this shortage of technology education and support, it is not surprising that most teachers are not using computers in their curriculum. The 1995 Office of Technology Assessment report states that "only 9 percent of secondary school students reported using computers for English class, 6 to 7 percent for a math class, and 3 percent for a social studies class (p. 20)."

The lack of technology support for curriculum is not a new problem, however. An earlier Congressional report by the Office of Technology Assessment (1988) focused on student teacher education. According to this report, one of the primary reasons for the limited use of computers in the curriculum is that graduates of colleges of education have not been taught to use computers for curriculum support.

One of the major problems with technology use in K-12 education is its integration into the curriculum. Some teachers cite their view that computer use is an addition to the curriculum, not a way to help students learn in required areas within the curriculum. Since the early adoption of the computer into education, there has been concern about the poor quality of software. In a study conducted by Becker (1987) the percentage of computer usage dedicated to science instruction was approximately 6% in high school, 3% in the middle grades, and 1% in the lower grades. Some software incorporates drill and practices activities in a game format, but does not help correct student misconceptions. Indeed, some software which is designed to engage students (by using a game format), actually distract student attention away from the educational content and hinder learning. Teachers desire quality software which addresses the curricular goals and objectives which they are expected to meet, instead of software which they have to "fit" into the curriculum.

Method

North Carolina A&T State University is part of a school-university partnership with several schools throughout the Western North Carolina area. In the Professional Development Schools (PDS) agreement, the partnership schools identified the use of technology as a weakness in their educational delivery. As a result, one of the goals of the PDS agreement is to increase the educational use of technology in the PDS schools.

The purpose of this project is to teach student and professional teachers to effectively use computers to support their curriculum. Traditional preservice and inservice training methods have not resulted in this outcome. Therefore, a non-traditional approach is needed which incorporates the best of the traditional methods but overcomes the weaknesses of each. For this project, preservice and professional teachers will be brought together within the structure of the established school-university partnership in a collaborative computer-curriculum integration effort.

This project draws upon a non-traditional approach to preservice and inservice computer technology education. Traditional inservice and preservice education have always been separate ventures. Schools conduct their own inservice training programs to meet their need for teachers prepared to use technology in the classrooms. These efforts in the schools are independent of the universities, which conduct various computer training courses in their preservice teacher education programs to achieve these same goals. Current efforts have separated the education of student teachers and professional development of experienced teachers, often yielding marginal results (Sizer, 1992). This project merges preservice and inservice teacher education, rather than keeping them separate. It will combine the development of computer-based instruction with teacher education and professional development, bypassing traditional teacher education and inservice programs. Prior studies have shown that within the framework a school-university partnership, simultaneous teacher education and professional development streamlines the training process and may yield improved results (Breithaupt, 1997).

In this model, preservice teachers will complete a specialized computer technology training program developed to increase their computer-based instruction knowledge and skill through a series of computer training courses in their undergraduate teacher education program. This program will take approximately three school years to complete, and will culminate in a computer-based instruction research and development project specific to the teaching discipline of each student. The professional teachers will receive inservice training in the evaluation, selection, development, and use of computer-based instructional software. The inservice training will be held at the teacher's school, using the computers and equipment available on-site. On-site training ensures that the teachers will receive experience on the equipment available to them during their normal work.

Student teachers who have completed the specialized computer technology training program will be paired with professional mentor teachers during the student teaching practicum. These student-mentor teacher teams will be paired by subject areas. A network of resource consults will be made up of participants from the university and the schools to support the training and computer-based instructional activities of the student-mentor teacher teams.

In all cases, the collaborative effort will be under the direction of the professional mentor teacher. It is the mentor teachers' curriculum that will be supported by the computers, and it is their students who will receive the computer supported curriculum. The mentor teacher is the individual responsible for the outcome of this collaborative effort. Therefore, the number of meetings, classroom visits, and university support will be directed by each individual mentor teacher.

During this project, student-mentor teacher teams will be asked to identify areas of their curriculum which might be enhanced by the use of computer-based instruction. Based upon the needs and interests of the mentor teachers, they will be referred to specific university faculty, staff, and graduate students, or to their school's computer support personnel.

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STNet: A Network-Supported Environment for Student Teachers

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Abstract: Adopting the rationale of reflective thinking as the underlying philosophy, we developed the Student Teacher Network (STNet) to support student teaching. STNet provides an online place where university supervisors, experienced school teachers, student teachers, and students in the preservice program can discuss teaching issues and browse resources asynchronously. The first year experience indicated that we need a more comprehensive rationale to guide the design and the implementation of the STNet, a resource-rich environment to support student teachers, an effective university-school partnership to sustain the STNet, and reconsideration of the whole teacher education program in order to infuse information technology into teacher education program. Building a systemic and distributed teacher education network is one of the feasible alternatives.

1. Introduction

Using information technology to support teacher education is becoming a necessity in the realm of education. NCATE is adopting the technology requirements for teacher education proposed by ISTE [NCATE 1997][ISTE 1997]. Researches such as LabNet [Spitzer and Wedding 1995] and Teaching Teleapprenticeship [Levin and Waugh 1998] indicated the feasibility of implementing network-supported teacher education environments. And many other teacher education research projects presented at the SITE annual conference are exploring the possible routes for infusing computer network into teacher education programs. Recognizing the usability of applying computer network in teacher education, we decided to explore the possible ways of using computer network to support student teaching.

2. Rationales

Reflection is the key word and the main concept in our study. Reflection is the meta-abilities that persons use to rethink their doings. A reflective teacher has the mindset of self-responsibility and always takes the learner-centered perspective to rethink teaching. It is believed that reflective teachers are construtivist teachers. The objective of our study is to cultivate reflective and constructivist student teachers through the support of network environment.

The fundamental educational rationales for the STNet design are:

(1) Teacher as reflective practitioner. The concept of reflective practitioner is described by Schon [Schon 1987]. It is also adopted and studied by several teacher education researchers [Harrington, Quinn-Leering and Hodson 1996] [Hatton and Smith 1994] [Zeichner and Liston 1991]. The fifth year student teaching is the trasformative stage where student teachers change from the student mindset to the teacher mindset. It is a stage that has powerful influence upon teaching career. We hope that, with the support of network, student teachers could reflect their field teaching collectively.

(2) Teacher as active learner. The concept of teacher learning is becoming a reality while our world are moving toward life-long learning, learning organization, and learning society. Active learners are constructivists, even constructionists, they are not only continuously refining their knowledge by mental processing, but also restructuring their knowledge through constructing something. (constructionism is a word coined by Papert) [Kafai and Resnick 1996] [Papert 1996]. Teacher should be a constructivist as well as a constructionist. By providing new information technology content knowledge, pedagogical knowledge, and practical teaching issues through the STNet, we hope to help student teachers become active and contextualized learners knowing that

most of the teaching knowledge are embedded and situated in school context.

(3) Teacher as professional collaborator. Knowledge is socially-built and shared. Expertise and intelligence are distributed. Through collaboration and cooperation the teaching knowledge could be accumulated and shared. Through the creation of learning community and the social process of knowledge building, student teachers can move legitimately and peripherally from the peripheral of a community to the center of that community [Lave and Wenger 1991]. Computer network provides a virtual world where we can build the community of teachers.

In addition to the educational rationales mentioned above, we also believe that computer network has the potential to support the teacher education programs. What we are exploring is to find and to create strategies for effectively applying computer network to support teacher education. The STNet environment is an effort of integrating teacher education rationales and computer network in order to find an alternative route to enhance the student teachers' growth toward quality teaching profession.

3. Design Considerations

Based upon the underlying educational rationales mentioned above, our design of STNet considered the following design principles.

(1) For fulfilling the goal of cultivating reflective teachers, we adopted the dialogical strategy. Techniques of dialoguing include message posting, responding and commenting. We wished to provide an environment filled with critical but friendly climate to promote the depth of reflection.

(2) For actualizing the goal of nurturing "teachers as active learners", we designed a resource environment in which student teachers can find some information that they could use either for their student teaching tasks or for their personal knowledge growth. We know there will have some silent readers who seldom actively join a dialogue. We hope the moderating strategies used by moderators could attract them to gradually become active participants.

(3) For realizing the goal of educating professional collaborators, we invited experienced teachers as mentors (for telementoring) under the assumptions that the interactions among experienced teachers and student teachers might help student teachers build the sense of teaching community and the willingness of sharing their personal experience. We also created specific discussion forums for those preservice students in the teacher preparation program for the purpose of making the dialogical channels available for preservice, internship, and inservice teachers.

The dialogical strategy, the instructional resources, and the telementoring/moderating strategy guide the STNet design. STNet was implemented using LOTUS NOTES and Domino Server. Student teachers who are pursuing the "Computer" teacher certificates were invited to join the STNet experiment. Student teachers and critical others (such as moderators, mentors, and students in preservice program) use web browser to join the dialogue.

4. The Environment

Two screen interfaces of the STNet dialoguing are shown in Figure 1 and Figure 2(in Traditional Chinese).

There are three discussion themes in the STNet: teaching theme, knowledge theme and classroom management theme. Each theme is moderated by a separate team which is composed of one university professor, two experienced teachers, and one graduate student.

STNet also provides forums for preservice program students for the purpose of making them aware of the issues in student teaching. [read Wu et al. 1999 for more information about STNet and preservice students]. Full text search tool is also provided. Several supporting web servers were implemented to provide knowledge resources, teaching resources, and classroom management resources. STNet is actually constructed by a group of servers, with one of the servers as the portal site.

STNet is currently a closed environment. Student teachers and students of preservice programs are allowed to log into STNet only through account and password identification. We are considering to let the STNet become an open environment where school teachers, parents, community members, and critical others can express their opinion about teaching profession. We hope that STNet will be an expressive environment for the teaching community and be a communicative place for infusing opinions from multiple channels. We also expect that STNet will be a research place to explore the possibility of applying computer network in each stage of teacher

education (recruitment, education, licensure, certification, induction, and professional development).

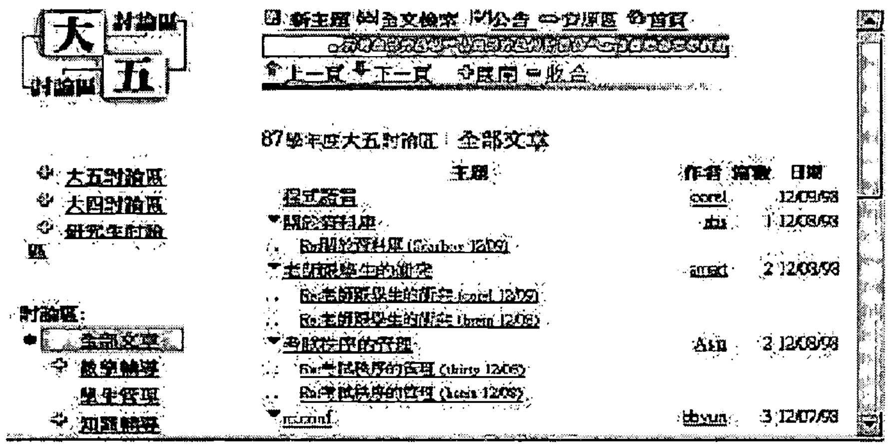

Figure 1: Screen interface of STNet dialogue area

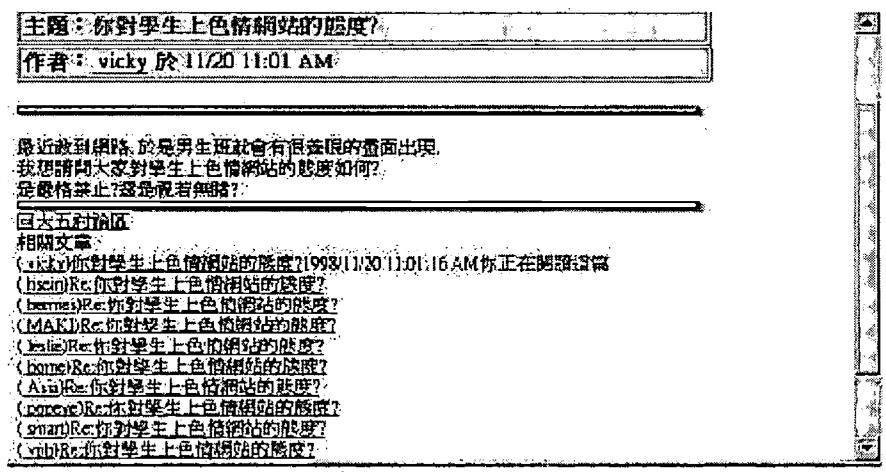

Figure 2: Screen of posted message and related responses

Figure 1 showed the index page of the asynchronous discussion. Participants could have quick overview of the discussion topics and the quantity of related responses. Hyperlinks to other discussion areas (such as graduate students' discussion area and undergraduate students' discussion area), to other discussion themes (teaching, knowledge, and classroom management themes), and to other places (home page, resource page, next page, previous page, full text search engine) were provided on the index page.

Figure 2 showed a posted topic and its related responses. One student teacher posted a real situation she had in her computer class (What would you do if your student is browsing the porn sites in your class?). STNet is a place in which collective thinking and collective problem solving will be nurtured. Through the help of STNet we can hear (read) student teachers' voices about the real school issues.

5. Experience, Issues and the Next Step

In retrospect to the first year experience, we have the following perceptions:

(1) Network technology is mature enough to be used to support the program of student teaching. During the process of developing STNet, neither hardware nor software seriously hampered the environment implementation.

(2) The asynchronous dialogue strategy was theoretically an appropriate one that can be used in the network-based virtual community, but practically it is still an unknown strategy with few evidence to prove its feasibility. How to effectively apply the dialogue strategy on the online virtual

environment still needs further understanding.

(3) STNet as a closed environment in the first year is necessary. We need at least a year to experiment our educational rationales and design principles.

(4) Resource-providing is a must at present time. We felt that a resource-rich environment is a success factor. Maybe the culture and the social systems are still on the level of searching, collecting, and interpreting existing information without much intention to move toward knowledge creation (such as the creation of teaching knowledge through collective ongoing dialogue).

Several issues were noticed during the first year experimentation:

(1) Frequency of participation was low. Possible causes include slow speed of networking, the unfamiliar interface of the STNet, the attitude toward supervised online discussion, and lack of incentives. Participation is the antecedent of collective reflection. Without high participation rate, the dream of promoting reflection through open dialogue will not come true.

(2) Level of dialogue was not deep enough. Many discussions were flying above the surface, not much reflective information could be collected from the forums. Topics usually died out quickly. The short thread of discussion indicated that there was not much substance in the dialogue.

(3) Lack of moderating experience. We were challenging ourselves to find and to create moderation techniques that could be fit into the STNet environment. The first year moderation experience was quite disappointing. Accumulating moderation experience is one of the most important tasks if we expect to have successful network environment to promote collective and open conversation in teaching profession community.

(4) Resources were not rich enough to attract student teachers. Our experience was that one of the effective strategies to market a forum (such as our STNet) is to provide timely and useful information and knowledge. Most people are "information collectors" and "silent readers". So are student teachers. Although we do not prefer the silent collectors and the silent readers, it is still too early to build teaching knowledge largely by experience sharing and reflective dialoguing.

The next step of STNet will be moved toward following directions:

(1) The search of a more comprehensive teacher education rationale. A comprehensive teacher education rationale should consider every stage of teacher education (education, licensure, certification, induction, and professional development) and should have a vision for whole teacher education profession, like the vision presented by US Department of Education [US Department of Education 1998]. The current functions of STNet didn't provide much information about the linkages of student teaching stage to other teacher education stages.

(2) The seek of more practical strategies for moderating asynchronous dialogue. We believe that teacher education should emphasize more on practical knowledge, field experience, and teachers' voices. We also believe that computer network can provide the power to push teacher education toward that direction. Creating online knowledge building community and constructing new teaching knowledge from real-world situation should have high priority. It is necessary to find asynchronous moderation strategies to create practical teaching knowledge that we believe will have great contribution to the teaching professionalization.

(3) The collection of more resources for student teachers. As mentioned earlier, there are still many information collectors and silent readers in the teacher society. For scaffolding those populations, resources should be continuously expanded and updated.

(4) The construction of tools. Electronic portfolio is one of the necessary tools for network-supported teacher education environment.

(5) The establishment of healthy school-university partnership. The professional development school (PDS) concepts developed and experimented for the past decade can be used to guide the future design of network-supported teaching knowledge building community. Through the school-based approach, we could have further understanding in the roles computer network can play in the promotion of the construction of teaching knowledge.

(6) The improvement of user interface. STNet users felt that it is getting difficulty for them in knowing which topics they have read and which they have not read yet. With the quick expansion of discussions, users are getting lost (but it is not an information overload phenomenon) and are feeling the burden of self-tracking the discussions. It is necessary to design tools to help users lessen the operational burdens.

6. Concluding Remarks

STNet is a network-based virtual environment where participants can browse resources or join the dialogue. It supports asynchronous discussion. Conceptually we believe our initial rationales and

strategy are reasonable, but in reality we now knew we should use a systemic approach to develop a comprehensive teacher education network, not just to build a network environment for student teachers. One of the possibilities is to set up network-based environments for preservice, internship, and inservice programs respectively, and then linking them together to build a distributed teacher education environment.

Software tools for teacher education are rare. We need a clear picture depicting what tools are necessary for a distributed teacher education network. For example, we might need a portfolio tool to implement case methods, journal writing, and other qualitative methods.

Our conclusion is that collective activity will be the essential component in any network-supported teacher education environment. Therefore building activity-based (not just resource-based) network environment to support teacher education will be the main challenge.

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Making the Connections: Development of Integrated Literacy Strategies Through Electronic Exchanges

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Abstract: This paper examines issues that resulted from a collaborative effort regarding the integration of literacy strategies with technology. Connections by means of electronic exchanges were established between students enrolled in a secondary teacher education methods course and second graders enrolled in a distant public school classroom. Although telecommuting projects have been lauded for their potential to stimulate the use of technology and promote integrated learning, such projects are not easy tasks or quick ways to bolster the use of technology and its application for integrating literacy development. This paper examines the opportunities and obstacles related to establishing connections between the university and public school as well as making the connection with reading, writing, spelling, art, and technology for early literacy.

Project Description

The following is a description of Project CONNECT, an electronic exchange between secondary education students and students in a second grade public school classroom. The funding for this project was provided through a grant awarded by the Martha Holden Jennings Foundation and was a collaborative project designed by a second grade classroom teacher, a secondary education methods professor, and an instructional technology professor. Our primary goal was to establish connections that would bolster the use of technology and its applications in order to promote literacy development. We believed that making the connection between the university and the public school by establishing electronic communication would be a relatively straightforward task. The technology literature indicated that e-mail's simplicity and usefulness made it the most far-reaching, widely-used Internet tool (Classroom Connect, December 1997/January 1998). E-mail was also lauded as one of the greatest communication tools currently available, and telecomputing technology was praised for its potential to facilitate collaborative learning (Newman, 1994; Naugh, Levin & Smith, 1994). We firmly believed that e-mail was a rudimentary tool for the integration of technology in the classroom. If we are going to use technology in our classrooms and model technology applications on a regular basis, we must first establish e-mail as an online communication tool for our students. Therefore, our grant stipulated that e-mail would be exchanged throughout the academic year and that the project would also integrate literacy skills with the curriculum. We made a decision to read the print version of *Time for Kids*, a news magazine that provided information about current events and features on interesting topics, as a means of establishing a communication connection between the education students and second graders. The education students generated questions related to the magazine articles as well as interpersonal exchanges and transmitted their writing once a week via e-mail to their second grade cyberpals. The second grade students then responded to the content-related questions and also included their personal thoughts.

Project Activities

At the beginning of the project, the college instructors completed paper work to provide university e-mail accounts for the education students and scheduled weekly computer lab times for the students to send their e-mail messages. All education students participated in a training session on how to use e-mail. The project directors arranged to send the education students' exchanges to the second grade teacher's account in order to facilitate management of the electronic communication at the elementary school.

Prior to the initial communication, the second grade teacher visited the methods class and gave the education students background information regarding each individual child's interests and personality. The elementary teacher also explained the reading and writing abilities of second graders, and suggested developmentally appropriate strategies to use to facilitate communication with the youngsters. The college professors also visited the second grade classroom, worked with the children, and surveyed the available technology (five computers grouped in a pod) at the elementary school level. These visitations helped to launch the project as we embarked upon the cybercommunication adventure.

The first exchange involved education students e-mailing written physical descriptions of themselves to their second grade key pals so that the youngsters could draw a picture of their university cyberpals. The project directors also took digital pictures of the students during visits to the university and school classrooms. It was helpful to match cyberpals' names to faces by viewing the children's artwork and the digital photographs.

Throughout the course of the project, students exchanged weekly e-mails related to the *Time for Kids* magazine articles. University students served as electronic mentors and helped second graders explore such topics as the planets and distant stars, disarming land mines, the wolf packs in Yellowstone National Park, the secrets of ancient Nubia, rain forest fires, the World Series, spiders, changes in minting U.S. currency, and dinosaurs. The e-mail dialogues regarding these readings served to open the youngsters' eyes to the world around them and the education students' eyes to the literacy abilities and interests of second graders.

Outcomes of the Project

The outcomes of integrating the e-mail project with literacy skills and curriculum content were numerous. The second graders developed many skills including: basic typing skills and keyboard awareness, greater ability to write original sentences and paragraphs, the ability to read with purpose, the ability to compose answers to university students' questions about the magazine's topics, dictionary skills, peer editing skills, and oral reading abilities (they loved to share the e-mails they received from the university students with their classmates).

The secondary education students had an opportunity to engage in a "cyber-field placement" which none of them had experienced previously. They quickly realized the power that technology holds as a communication tool. They honored the opportunity to nurture a one-on-one relationship with a child. It was interesting to note that by the fifth week of the e-mail exchange, the second graders were sharing some poignant questions and concerns with their university cyberpals. Examples include: "Do you have a dad?" "Yes I did read about the world heating up and that's not right burning our world up." "My dog died and I am sad." "Would you like to go fishing with me?" "I am sad because this class is over and this is my last letter. I liked all of your letters." University students became much more aware of the importance of serving as counselors and trusted advisors for the children. The education students gained valuable insights about the literacy development of young children (e.g., invented spellings -"I like fruits *exspeshuly* apples." "Your *freiand* Johnathan."), and often struggled to carefully construct sentences that were not too lengthy or did not contain difficult vocabulary for second grade readers. The education students also witnessed the positive effects generated by this technology experience (e.g., improved writing, reading, and computer literacy skills), and they became more confident regarding their ability to integrate technology in classroom practice.

The most rewarding benefit for the project directors was the opportunity to collaboratively team in order to integrate technology and curriculum for our students. Teaming was possible because we knew each other well (the second grade teacher was a former student of the methods professor, and the methods professor and technology professor were colleagues at the same university) and we had previously shared

positive experiences working together. Just as trust is important to the classroom environment, trust and respect for one another's professional perspectives is critical to successfully teaming for an educational project. Project CONNECT would not have been implemented without first considering ourselves friends and our individual capacities for collaboration. There were many times throughout the experience that it would have been easy to disband the project given the frustrations and obstacles we jointly faced.

Obstacles of the Project

An analysis of the obstacles encountered involved concerns that can be loosely grouped into the following three categories: technology operations, project management strategies, and ergonomic considerations. Scheduling the weekly use of the computer technology for e-mail exchanges proved to be a daunting experience at both the elementary school and college level. Although the elementary school network had a direct connection to the Internet, connectivity at the college was limited to three dial-up connections to the campus electronic network. Therefore, access to the university's Unix server became problematic because the number of university students attempting to access the network via the modem connections exceeded the capacity of the university modem pool. On many days it was simply impossible for the education students quickly and efficiently to log on to the network. Additionally, throughout the project, the university system continuously and randomly severed the phone connections. The resulting frustration served to dampen the education students' enthusiasm regarding the ease of implementing technology in the classroom.

At the elementary school setting, the second grade teacher and his students also experienced similar feelings of frustration because the electronic lines of their system were down several times during the project. The lack of technical support to reestablish electronic communication capabilities was particularly vexing to both the classroom teacher and university professors. A number of long distance phone calls were placed between project sites to explain the respective situations and to assure one another that we would try resending again as soon as possible.

The classroom teacher faced an additional problem because his classroom was limited to the use of three networked computers and two Alpha Smart Boards. Given that second grade students' typing skills are not very fast, it became very time consuming for twenty-three children to compose and send e-mails to their university cyberpals. By its very nature, student computer work does not lend itself well to whole group instruction (DeVoogd, 1995). The classroom teacher had to constantly shift from whole group activities to small group work and also provide individual help to the children working at the computer pod.

The need for well-developed management strategies and organizational support became evident during the initial phase of the project. Although a grant award was obtained in order to finance the project, conditions of the award restricted expenditures to the purchase of supplies and materials for the public school; thus, no supplies could be purchased for the university students. Teachers often spend their own money to purchase necessary supplies for their classrooms. However, technology undertakings are not inexpensive and it should be noted that approximately nine hundred dollars was expended for this project to purchase technology supplies, paper, subscriptions to *Time for Kids*, and funding to print a booklet of the students' e-mail exchanges and art work. The project directors did not foresee funding problems at the college level because the university students were required to pay a lab fee that covered unlimited use of computer supplies in the college computing laboratory. Since the education students were going to create and retrieve their e-mail exchanges in this lab, we erroneously thought that there was no need for additional supply funds.

On paper this project was well designed, reasonable, and workable. However, during the first week of the project, circumstances changed drastically. Enter Murphy's Law of technology use! Access to the university system via the college laboratory's computers became unavailable during the methods class' scheduled lab time due to scheduling conflicts. Unfortunately, this sole computing laboratory had to accommodate the needs of both undergraduate and graduate education students, as well as educational technology classes. Additionally, the university computing services department took more than three weeks time to provide education students with personal Unix accounts. The project directors quickly had to develop a contingency plan that involved sending the university students' e-mail message from the professors' office computers and their home computers, as well as receiving the second graders e-mails by means of this same connection. This created a weekly logjam on the professors' personal computer

systems. Unfortunately, no funds were available for the purchase of essential supplies such as diskettes, printer ink cartridges and paper for these locations.

Management problems also occurred in the elementary school classroom as the second grade teacher attempted to track which students had responded to their university cyberpal and which students had not yet replied. The teacher valiantly tried to maintain an accurate account of who had mailed their responses; however, this task was a difficult undertaking when compounded by the tasks of dealing with network problems, teaching the regular curriculum, and attending to the needs of all students. Absenteeism among the second grade students and university students was also difficult to manage for prompt e-mail exchanges.

The three networked computers in the second grade classroom were arranged on trapezoidal tables in a three sided semi-circular pod. This arrangement enabled the teacher to create a computer learning center in one section of the classroom. The pod arrangement allowed the teacher to decrease the chance of student injury by placing electric cords, computer cables, and printer cables in the center of the pod well out of the reach of the second grade students. However, this safety advantage created a problem that involved the lack of adequate table space for students to use for their materials. The table surface proved entirely too small to accommodate a computer system, student papers, and necessary reference materials. The need for adjustable computer tables and chairs in the elementary classroom was also apparent. Not only were the tables too high for the second grade students to correctly position their hands and wrists for typing, but the seats of the chairs were too high and many students' legs could not touch the floor. This situation highlights the need for the purchase of suitable equipment for technology integration at the elementary level. Telecomputing efforts must address all of these glitches, and educators must be forewarned about how easily these activities can be thwarted by the unreliability and lack of equipment, the difficulties of technology operations, the vexations regarding technical problems, the challenges of imperfect classroom environments, and by the inadequate ergonomic conditions experienced by students.

Summary

Integrating technology into the curriculum is no simple task, and our experience with Project CONNECT has revealed that educators should expect glitches and disruptions throughout such a process. Despite the obstacles encountered, we recognize that technology integration efforts work much better when educators make connections that address the systematic changes required for successful technology applications in public school and university classrooms. These connections include collaborative efforts between university and public school educators, funding for innovative educational projects provided by foundations, integrating interdisciplinary versus single subject learning with technology, and the willingness to engage in experimental approaches to teaching such as electronic mentors.

Although we faced difficulties that, at times, short-circuited our connections, the electronic exchanges served to motivate and improve second graders' writing, reading, and computer literacy skills. It also provided the opportunity for pre-service teachers to practice effective technology applications and experience how to integrate technology to promote student learning. The success of the project indicated that a methods course is a natural point in the sequence of a teacher education program at which to establish a connection for technology integration. Lastly, some of the most valuable benefits of Project CONNECT were the momentum generated for learning by all individuals connected to this endeavor and the realization that the dynamic nature of technology integration requires making many more connections than simply an electronic connection.

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Infusing Technology Into the Foundations of Education Course: One Model

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Abstract: Although many national reports have challenged colleges of education to better prepare preservice teachers to use technology in their future classrooms, studies have shown that most university faculty are not modeling the use of technology in their own teaching. This paper will offer suggestions as to how an education faculty member can integrate and model technology use in a traditional foundations of education course.

Introduction

By now most of us in teacher education are well aware of the many challenges to and the criticisms of our teacher preparation programs in regards to technology training. For example, in its report titled *Technology and the New Professional Teacher: Preparing for the 21st Century Classroom* (NCATE, 1997), the National Council for Accreditation of Teacher Education states that "The nation's teacher education institutions must close the teaching and learning technology gap between where we are and where we need to be. Teacher education institutions must prepare their students to teach in tomorrow's classroom (p i)." In response to such reports, many teacher preparation programs have established a required educational computing course (Aschermann, 1997; Leh, 1998; Gunter, Gunter, & Wiens, 1998;) and/or are attempting to infuse technology use throughout their programs, especially in their methods courses (Bloom & Handler, 1997; Drazdowski, Holodick, & Scappaticci, 1998; Fox & Thompson, 1994; Levin & Waugh, 1995; Schrum, 1994; Stuhlmann, 1998; Todd, 1993). It has been observed, however, that most university faculty are neither modeling the use of technology nor requiring students to use technology (Blanche, Matthew, & Thomas, 1998; Bauer, 1998; Drazdowski, 1995; Vagle, 1995; Wetzel, 1993). As the Office of Technology Assessment (1995) reported to Congress, most technology instruction in colleges of education involves teaching about technology as a separate subject, not teaching with technology by integrating it into other coursework to provide a model for instructional use. The following paper will describe how one education faculty member is attempting to integrate and model technology use, with specific examples taking place in the foundations of education course.

Construct Multimedia Teaching Classrooms

Most education majors begin their teacher preparation programs with a basic course of some type in educational foundations, so I suggest that we in teacher education begin at the beginning in regards to technology use. Modeling has proven to be a very powerful teaching strategy (Bandura, 1977; Scotter, 1994), and I feel that technology modeling by the professor in the foundations course is critical for setting the tone for the rest of the preservice curriculum. Through the efforts of the education department at my college, three model classrooms have been constructed. These classrooms are equipped with a teacher station consisting of a Macintosh multimedia computer, a color LCD projector, and a large viewing screen. The computer is connected to the campus computer network, making Internet use possible. I feel that such easy access to the technology in the actual teaching classroom of the professor is critical if true integration is to take place in any program.

To paraphrase Kevin Costner's character in the movie *Field of Dreams*, "Build it and they will come." Following are a variety of ideas for technology use in the foundations of education course. Though

certainly not an exhaustive list, they are all ideas capable of being incorporated in an initial year, leaving many opportunities for growth and fine-tuning in subsequent semesters.

Use Computer-Generated Presentations

Begin the first class with a computer-generated presentation of your syllabus. Research has suggested that the visual literacy fostered by use of technology can help develop learning skills that are important enough to be considered a kind of intelligence (Roblyer, 1998; Christopherson, 1997). And as many authors have reported, presentation software packages offer the presenter many advantages, such as impressive graphics, animation, class notes and audience handouts, helping the presenter feel more organized and prepared, and allowing the presenter to face the audience and interact instead of facing the blackboard and scribbling notes (Barlett & Wilson, 1998; Grandgenett, Grandgenett, & Topp, 1994). *PowerPoint* and *Astound* are currently two of the most popular computer presentation programs available, and both allow the user to convert presentations to HTML format for viewing over the Internet. All such computer presentations that the professor (or the students) designs for subsequent lessons in the course can be made ready for inclusion on your Web page.

Use the Internet Extensively in Your Classroom

As mentioned previously, the education classrooms at my college are multimedia ready and the computers in each class can access the Internet. Thursdays have become "Web Site of the Week" in my foundations of education class. I begin the class by projecting a site that is appropriate to the class topic, whether it be effective schools research, John Dewey and the progressive movement, or a teaching idea site like the *Teachers Guide for the Professional Cartoonists' Index* (http://www.cagle.com/teacher/). I then quickly demonstrate some of the major features of the site. I also print and duplicate a hard copy of the site home page along with the URL so students can further investigate the site on their own. Additionally, at least one of the references in their philosophy of education reflective paper must come from the Internet, and students are free to e-mail me at any time with questions or concerns about class or assignments, or can submit their weekly journal entries as attachments through e-mail.

Create a Multimedia Review Stack of Course Material

I've used the multimedia authoring program *HyperStudio* to create a multimedia review stack of the major concepts and theories covered in the foundations of education course. Based on a Jeopardy type format, students can use the computers in the department's *Teacher Technology Center* to review course material as needed at any time. Besides helping students learn the material and prepare for their exam, the stack also acts as a model for what these preservice teachers will be learning in their "Multimedia Design" course, which is required for all the education majors at our college before their student teaching experience. Some senior students also refer back to the stack as a refresher before taking their National Teachers Exam.

Demonstrate Appropriate Computer Software

Education professors should utilize various computer programs in class when appropriate. For example, I like to use the program *Inspiration* to create "concept" (Wilson, 1998), "thinking-process" (Hyerle, 1996), or "knowledge maps" (Danserau & Newbern, 1997) with students during class discussions or brainstorming activities. After selecting a symbol, such as a square or oval, the "rapid fire" feature of the program allows the user to record ideas as quickly as they can type them. The program also allows the user to transform any diagram into an outline view, and to keep notes for further development of any

symbol in the diagram using the "notes text" feature. Our department has recently purchased a site license for the program, and we will be installing it on all of the computers in our lab for student use.

Another suggestion is to model the use of teacher utility programs. Keep grades and distribute progress reports with a grading program, utilize a calendar maker to keep the class informed of upcoming dates for presentations, projects, and papers, and use clip art, scanned images, and digital photography to enhance class handouts and exams. When appropriate, use a spreadsheet, database, charting or multimedia program as a "mindtool" (Jonassen, 1996) with the class.

Encourage and Support Computer Use for Class Presentations

Beginning with the Fall of 1997, all freshman entering King's College are now required to take a set of technology literacy modules. In the "computer-supported presentation module," students learn the basics of the *PowerPoint* program. As these students come to my foundations class as sophomores, I have been able to encourage them to use the classroom computer to support the class presentation of an educational article that all students in the course are required to make. Students have also been quick to model my Internet use and to incorporate an appropriate Web site or two into their class presentations. The department has also invested in a portable mouse for the classroom, a *GyroPoint Pro,* that uses a radio signal instead of infrared technology. This makes it possible to transmit the signal to the computer through walls and even people from up to seventy-five feet away. Students (and the professor) are no longer chained to the computer station, but instead are free to wander about the room and interact with the audience.

Conclusion

As each semester progresses, I look forward to incorporating other aspects of technology into my foundations of education course. For example, when the college dormitory rooms are wired for Internet access by the end of this year, a list-serve to encourage further out of class discussion might be appropriate. Our department recently purchased a recordable/rewritable CD-ROM drive, so the multimedia review stack that I created and other relevant course materials may be burned on to one CD-ROM for student use in the near future. I also know that I must continue to improve my own technology skills while I continue to actively model technology use in my own teaching. I agree with the OTA (1995) report that stated " One conclusion to be drawn is that telling students about what is possible is not enough; they must see technology used by their instructors, observe uses of technological tools in classrooms, and practice teaching with technologies themselves if they are to use these tools effectively in their own teaching" (p. 185). Hopefully by modeling and integrating technology use in all of our teacher education courses, we will begin to foster a generation of technology using educators who will transform teaching and provide more engaging learning opportunities for their students.

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The Development of Technological Competence in an Undergraduate Teacher Education Program

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Abstract: The purpose of this report is to discuss the educational technology initiatives designed by a college of education to ensure undergraduates in a preservice program acquire the basic and advanced competencies required for licensure in the state. University faculty have been challenged with creating a framework for introducing preservice teachers to these competencies, integrating them into existing coursework, and enhancing student competence by preparing them for the Essential Technology Skills Inventory (ESTI) and portfolio exhibitions.

Background

In 1994 a Task Force was established to recommend educational technology initiatives which would eventually encompass the total North Carolina Educational system. Comprised of six representatives each from the Department of Public Instruction, the Community College System, and the University of North Carolina System, this Task Force created a list of technology competencies for inservice teachers, teacher education faculty, and preservice teachers in the state. Public school teachers are now required to obtain three to five renewal credits which translates to 30-50 contact hours involving technology. These hours could include attendance at workshops or conferences, participation in faculty development or training sessions, involvement in a research project, teaching a distance learning course, or integrating technology in instructional presentations. Every College of Education received permanent funding for a non-tenure track faculty position and a one-time allocation for procurement of technology resources. Teacher education faculty must now be proficient in technology competencies and practice the integration of instructional technology in their courses. Methods faculty must maintain licensure in their content areas or field with renewal credits being earned in technology. Each institution of higher education was given the authority to devise and implement a technology program for their preservice students and teacher education faculty. Preservice teachers must now demonstrate competency in computer skills. Beginning in the spring of 1999, a passing score on the Essential Technology Skills Inventory (ETSI) and the development of a technology portfolio will be required for a teaching licensure.

Purpose

The purpose of this report is to discuss the educational technology initiatives designed by a college of education to ensure undergraduates in a preservice program acquire the basic and advanced competencies required for licensure in the state. These competencies address a range of computer applications designed to improve student learning, support effective teaching, and enhance overall teacher productivity.

University faculty have been challenged with creating a framework for introducing preservice teachers to these competencies, integrating them into existing coursework, and enhancing student competence by preparing them for the Essential Technology Skills Inventory (ESTI) and portfolio exhibitions.

Basic and Advanced Competencies

The basic technology competencies defined by the task force include skills and knowledge in the areas of: Computer Operation; Setup, Maintenance, and Trouble Shooting; Word Processing and Introductory Desktop Publishing; Spreadsheets and Graphing; Databases; Networking; Telecommunications; Media Communications including Image and Audio Processing; and Multimedia Integration. The ESTI was designed to assess the basic knowledge and skills of preservice teachers. Advanced competencies include: Curriculum; Subject-Specific Knowledge; Design and management of Learning; Child Development, Learning, and Diversity; Social, Legal, and Ethical Issues. Verification of competence in advanced areas must be demonstrated in a portfolio format.

Methodology

Phase One

At Appalachian State University (ASU) we began to address the state initiative to produce technologically competent preservice teachers in phases. To spearhead this process, a technology specialist was employed and surveys were conducted to assess the existing technology available to faculty and students in the college of education, to determine the current implementation levels of technology in university courses, to assess student levels of skills with computers and other technologies, and to provide assistance to faculty in creating relative learning experiences for preservice teachers. Students participated in pilot testing an instrument in the assessment process that would be used as one criterion for teacher licensure in the state of North Carolina. On a self-report students initially described their technological competence. Between 91% and 99% of students felt most competent on the use of overheads, word processing, email, and the web. Less competence was reported on the use of listservs, laser disc players, databases, spreadsheets, scanners, distance learning, LCD panels, and multimedia presentations. Only 14-56% of the students stated competence in these areas (Jenkins & Duke, 1997).

Phase Two

A Technology Portfolio Study Group in the Reich College of Education (RCOE) at Appalachian State University was appointed to develop a plan for assisting students in meeting the State Board of Education mandates. The following questions were drafted to direct the work of the group:

What kinds of evidence should students use in demonstrating an appropriate level of proficiency for each competency?

How should the evidence be presented by students?

How should the evidence be evaluated and by whom?

When should students be expected to submit their evidence of meeting the competencies?

What "help" can we provide students in preparing for this assessment, especially during the first assessment actually linked to teacher licensure?

The RCOE Technology Curriculum Specialist directed the efforts of the six-member group as these questions were addressed and recommendations were forwarded to appropriate administrative offices. These suggestions took into account the emergent nature of the process.

The Technology Portfolio Study Group made recommendations to the RCOE in the areas of orientation, presentation and evaluation, and faculty expectations. Given that early and motivating experiences with emerging technologies is an integral aspect of teacher preparation, an orientation session was planned for all preservice teachers enrolled in the introductory course CI/SPE - 2800 - Teachers, Schools, and Learners. A web page was posted to provide students the opportunity to complete a pre-assessment instrument to determine individual skills with the basic and advanced competencies. Auxiliary workshops were created to address and remediate specific areas of weakness noted in the basic skills assessment. Students were to assume responsibility for selecting and scheduling workshops. Five topics suggested were general computer use and other entry level information, databases, spreadsheets, image manipulation, and the portfolio process. Methods faculty were encouraged to integrate the advanced competencies into course experiences and assignments. The technology coordinator would serve as a resource in the planning, implementation, and evaluation of the integration.

Students would be required to participate in the state testing of the basic skills (ETSI) and to present a technology portfolio to demonstrate mastery of the advanced competencies. This portfolio must be completed and approved prior to application for licensure. The following checksheet (Figure 1) was designed to assist the university student in documenting mastery of technology skills.

RCOE ADVANCED TECHNOLOGY COMPETENCIES COMPLIANCE FORM

Student:__________ **SS#**__________ Major:__________ Designated Level Met___ Not Met

Signature	Date	
		10.0 Curriculum
________	____	10.1 Use the computer skills curriculum...
________	____	10.2 Use school television resources...
________	____	10.3 Access resources for...via telecommunications
________	____	10.4-5 Demonstrate ...practical application of NCCSC & NCCSA
________	____	10.6 Know how to locate, evaluate, select...teaching resources
		11.0 Subject-Specific...
________	____	11.1 Use technology in the subject for learning...
________	____	11.2 Use media/technology to present subject...
________	____	11.3 Use technology-based tools...specific to discipline
________	____	11.4 Use technology to facilitate teaching strategies...discipline
		12.0 Design & Management...
________	____	12.1 Develop performance tasks...to locate & analyze information...
________	____	12.2 Use computers/technology...to collect information on student learning...
________	____	12.3 Use computers/technology...to communicate...to...parents...
________	____	12.4 Demonstrate...appropriate physical settings that support...student learning...
________	____	12.5 Demonstrate...organizational & management strategies...
________	____	12.6 Demonstrate...application of resources...including satellite, cable...
________	____	12.7 Select & create learning experiences...

13.0 Child Development...

________________ ____ 13.1 Use media/technology to address differences in children's learnig...

________________ ____ 13.2 Use media/technology to support learning for children with special needs

________________ ____ 13.3 Use media/technology to support learning for...[ESL children]...

________________ ____ 13.4 Use...local, state & national services/resources to meet diverse learning needs

14.0 Social, Legal, Ethical...

________________ ____ 14.1 Establish classroom policies and procedures.

________________ ____ 14.2 Ensure equal access to media/technology resources for all students

________________ ____ 14.3 Demonstrate knowledge through...application of social, legal, ethical issues...

The above student has met or exceeded the necessary level of proficiency.

____ ________________
DIRECTOR OF FIELD EXPERIENCES DATE

Figure 1: Checklist of Advanced Technology Competencies

Phase Three

The university students will be required to participate in the state technology testing which will be a criteria for acquiring teaching licensure in the spring of 1999. Faculty are currently addressing this mandate and providing support to preservice teachers in a multitude of ways. However, there is much concern about the reliability and validity of the assessment instruments and the administration of the tests. Initial surveys have shown:

1. Both new and career teachers unquestionably need to be technology-proficient but the skills they need vary greatly with grade level and content area or discipline.
2. Developing and being tested on generic computer skills has extremely limited value. Far more critical are the development, application, and assessment of technology skills in the context of teaching and learning.
3. Any list of basic technology skills is outdated almost before it is distributed, given dramatic changes almost monthly in technology, so the list of basic skills endorsed by the State Board of Education three years ago is not today's list of essential technology skills.
4. Developing a basic skills test like the ETSI(Essential Technology Skills Inventory) might have been useful during the year after the skills were identified, but it is as outdated today as the skills are, and it will need to be revised annually or bi-annually at great expense to the state to be useful.
5. Portfolio and produce assessment-that is, assessment of a teacher's instructional materials and strategies in a specific content area for a specific group of children-is a far more meaningful way of assessing not only the teacher's basic technology skills, but, more important, his or her ability to use those skills in ways that enhance PK-12 learning.
6. Lastly, North Carolina is rapidly implementing procedures for product and portfolio assessment that begins during a teacher's preservice program, continues during his or her initial three years of teaching as part of the Performance-Based Licensure process, is required during an advanced master's degree for advanced licensure, and culminates in the portfolio created for National Board certification. Throughout that continuum, teachers have multiple opportunities to apply and document their technology skills in actual work with children (UNC Deans' Council, 1998).

Faculty are actively seeking statistical information supporting the ETSI.

Conclusions

A majority of preservice teachers entering teacher education programs lack positive attitudes and the skills and knowledge to use computers. Successful teaching in the 21st century demands competence in these areas. Therefore, faculty at institutions of higher education must integrate these goals into existing programs of study. The gap between where we are and where we need to be must be closed (NCATE,1997). In the process, faculty should strive to foster positive attitudes towards the use of technology in preservice teachers (Clawson, 1996) as these initial experiences with computers will impact the likelihood that they will use technology in their own classrooms (Reznich, 1996). Technology products must be developed, used, and assessed during preservice programs and expanded and enhanced during a teacher's tenure in the classroom.

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THE FIFTH DIMENSION CLEARINGHOUSE: ONE STRATEGY FOR DIFFUSING, IMPLEMENTING, AND SUSTAINING CORE PRINCIPLES

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Abstract: The development and implementation of the Fifth Dimension Clearinghouse has been a three year process. This report highlights key aspects of the diffusion and propagation process and details the core principles of Fifth Dimension.

Background

The Fifth Dimension is a distributed literacy consortium of researchers from universities in America, Mexico, Australia, Sweden, Spain, Israel, and Russia. At the macro level, the Fifth Dimension is a cultural system containing rules, artifacts, divisions of labor, and outcomes that mediate the social constitution of local Fifth Dimension cultures. Our project focuses on the design of a model activity system that instantiates theoretical principles of cultural-historical activity theory (Cole, 1995. 1996; Cole and Engstrom, 1993; Ilyenkov, 1977; Leontiev, 1981; Luria, 1979; Vygotsky, 1967; 1978; Wertsch, 1985; 1991). The overarching goals of the Fifth Dimension are to provide contexts for children to master and appropriate knowledge and skills mediating changes in their everyday practices, and to provide a context in which undergraduates from teacher education have opportunities to connect theory with practice while delivering services to children.

Our research results have demonstrated that the Fifth Dimension provides additional opportunities for children to engage in academic tasks, that children achieve at increasingly higher levels on tasks in which they engage, (Cole, 1995; Nicolopoulou & Cole, 1993) and that they acquire proficiency in using technological tools in the process of attaining personal goals (Schustack et al., 1994; 1996; 1997). We have also learned that special education children who participate in the Fifth Dimension progress in the same manner as their regular education counterparts and with similar success (Blanton & Zimmerman, 1993).

When Fifth Dimension children are compared with their counterparts in control groups, significant effects are found for the Fifth Dimension group on measures of near transfer, such as computer skill and knowledge (Shustack et al., 1997), math and word problems (Mayer et al., 1997), and measures of far transfer, such as state-wide measures of reading and math achievement (Blanton et al., 1997; Mayer et al., in press). The results of these studies demonstrate that the core principles of the Fifth Dimension instantiate the theoretical principles derived from cultural-historical activity theory promote learning interactions in the Fifth Dimension.

Core Principles

Appalachian State University (ASU) is an example of the Fifth Dimensions around the world. It is comprised of interns enrolled in an undergraduate teacher education course, after school children between the ages of five and twelve, site coordinators who were previous interns, and university faculty and research assistants. Core principles have been designed to constitute each of our four sites as well as other national and international Fifth Dimension Sites currently in operation. These principles include the categories of structure, participation, and learning. Adult participants in this community of practice complete weekly fieldnotes which are used to determine the extent to which these core principles are developing.

Structure

- We focus on after-school whether in community or on school grounds.
- A sustainable Fifth Dimension must be a joint project between the community/ school and the college/university creating a multi-generational environment.
- The college/university provides some resources (undergraduates and field workers who interact with the children) and the community/school provides a space for the program (a living laboratory).
- Both research and implementation efforts are geared to focus on sustainable change.
- There are remediation strategies within and between systems, numerous zones of proximal development around new technologies, and systems making tools and rules for each other.
- There is a focus on determining zones of proximal development, the use of new technologies to connect systems together, and the distribution of choice and responsibility.
- There is an emphasis on interactive technologies, including but not limited to computers, telecommunications, and multimedia.
- There is a maze, represented either in a tabletop-size wooden structure of rooms and doorways, or a diagram of a network or "rooms." The maze structures a mix of choices, consequences, and chance between more and less experienced partners of tasks.
- There is a mythical/virtual entity, referred to at the various sites as The Wizard, El Maga, The Golem, The Poet Proteus, The Sun Wiz, or The Volshebnik who stimulates, amuses, oversees, coordinates, and bemuses participants throughout the telecommunications system.
- There is a focus on diversity, including goals, culture, and literacy.
- Intellectual resources and labor are distributed within and among Fifth Dimension sites.

Participation

- Activity must be a mixture of play and education. The play element is needed for the children to participate; the education element is needed from the adults to justify support.
- The mix of play and education must be such that the children come voluntarily.
- Activities must allow children a substantial element of personal choice and self- direction within an overall structure designed to promote all participants' development of level of expertise.
- Performance in the Fifth Dimension has no direct relation to any grading, testing, or evaluation in the children's regular school. It is an activity to be evaluated by criteria of success intrinsic within the Fifth Dimension community of practice.

Learning

- Learning is an active process that is fostered by mixing leading activities: teaching, learning, play, peer affiliation, productively coordinating diversity.
- The environment is rich in occasions for authentic problem solving and communication of the processes and products of problem solving.

- Children are encouraged to formulate through written and oral language and other modes of expression how they accomplish tasks and other sense-making activities.
- There is a maximum dependence on intrinsic rewards and choices within structured activities.

Diffusion

As a result of the levels of success experienced in the Fifth Dimension, it seemed timely to engage in a program to diffuse and propagate the principles and artifacts of the Fifth Dimension to a broader audience. According to Rogers (1993) diffusion requires that information be disseminated by a creator and interpreted by a potential adopter. The adopter must recognize the utility of the innovation.

We have created a virtual Fifth Dimension Clearinghouse to disseminate information through a World Wide Web Site. The goals for diffusion include developing awareness among other universities and local education agencies, creating a flexible telecommunications infrastructure that will enable the diffusion, installation, and adoption of the Fifth Dimension, sharing the principles, artifacts, and research with interested audiences, and providing a medium for collaboration among existing and emerging sites.

Function of the Clearinghouse

The function of the clearinghouse is to diffuse the Fifth Dimension and study the dynamics of sustainability, and to determine the extent to which emerging Fifth Dimensions are adopting and sustaining the core principles. The information and artifacts necessary for installing a Fifth Dimension are achieved in the virtual environment of the world-wide web. From the Clearinghouse site, housed at Appalachian State University, users can access everything from artifacts for use and adaptation in local sites, to technical reports and descriptive tables outlining the relationships between different universities and site management. Figure 1 represents the opening page of the Virtual Clearinghouse.

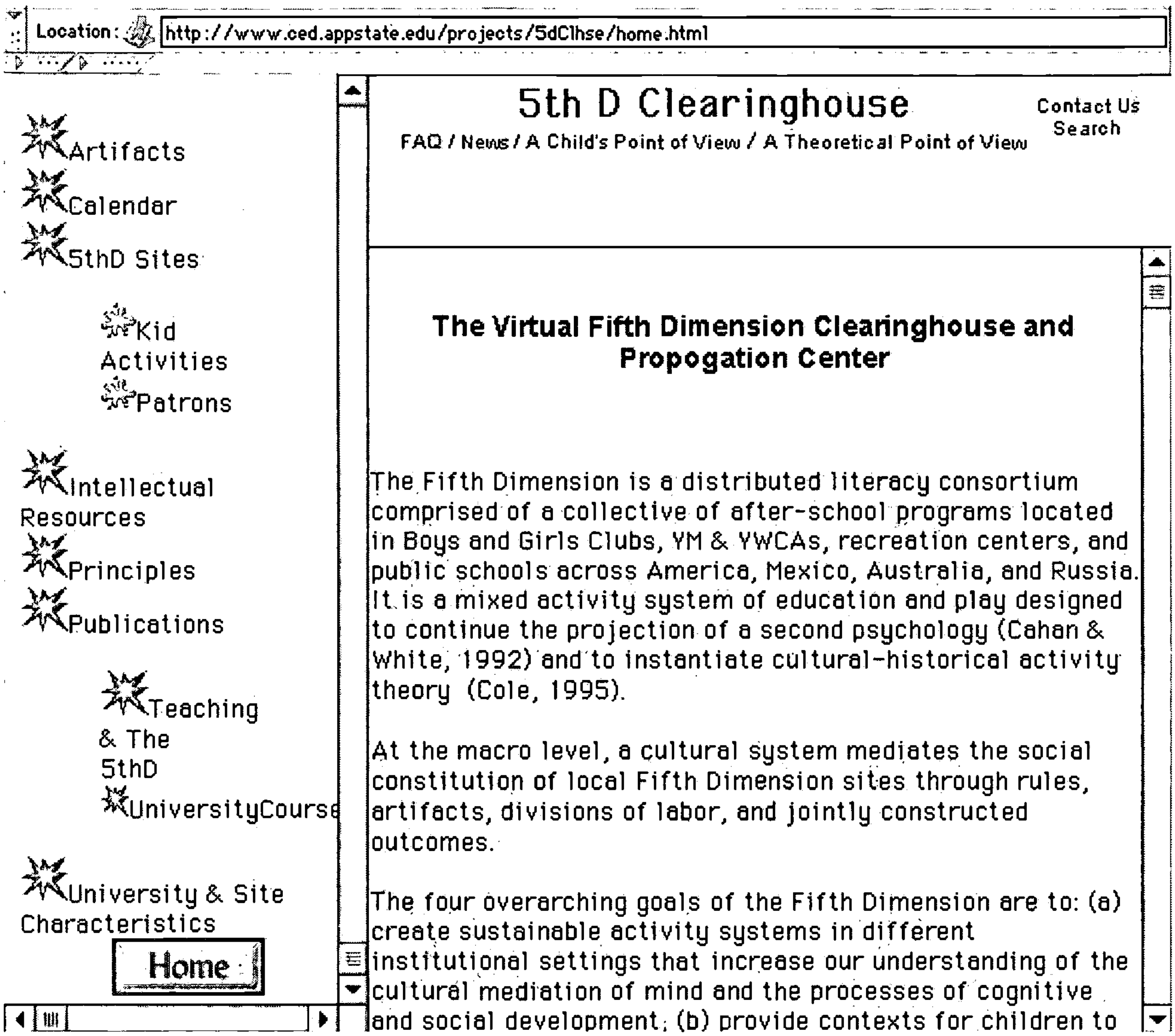
The headings in the table of contents take users to pages which provide the following services or information:

- Artifacts: the tools used to constitute a Fifth Dimension. The links above provide artifacts that may be printed or downloaded.
- Calendar: An interactive calendar which may be used to post events by anyone in the consortium.
- 5D Sites: Links to active Fifth Dimension Sites which publish web-pages. Also, lists and descriptions of all sites worldwide and their focus in working with children.
- Kid Activities: A description of how a Fifth Dimension should look from a child's point of view. Describes the use of imaginary patrons, who "run" each site. Provides links to interesting sites, educational sites, kid developed web pages (from Fifth Dimensions), areas to display kidwork, and a link to the intersite listserv for kids to communicate with one another (xkids).
- Patrons: A rationale for the use of imaginary patrons developed by individual sites and contains links to descriptions of existing patrons and their stories.
- Intellectual Resources: Pages that connect members of the consortium to philosophical internet resources dedicated to Cultural Historical Activity Theory (the philosophy which undergirds our core principles), research centers, professional organizations and professional journals.
- Principles: The set of core principles for constituting a Fifth Dimension site. These principles are organized under the categories of structure, participation, and learning.
- Publications: The repository for Fifth Dimension publications. Here are printable (and soon to be downloadable) technical reports, concept papers, bibliographies, proposals, and descriptive information.
- Teaching and the 5thD: Helping strategies for adult participants in the Fifth Dimension. Instruction is viewed as joint activity, the co-construction of a zone of proximal development by two or more participants, mediated through language and other cultural tools.
- University Courses: Fifth Dimensions are connected to university courses. The courses range from developmental psychology to introduction to teaching and research practica. These pages provide descriptions and examples of university courses which use the Fifth Dimension as an integral part of their labortory

experience for undergraduates.

- University and Site Characteristics: University characteristics provide an overview of how three universities have developed Fifth Dimension sites. Information is provided for the following: an Education oriented State School, a Research-oriented State School, and a Service-oriented State School.

Figure 1: Virtual Clearing House Content Page



An Incomplete Guide and Starter Kit for the 5th Dimension

For a nominal amount, the Fifth Dimension Consortium also offers a CD-Rom. The purpose of the Fifth Dimension CD is to provide information about the Fifth Dimension to universities, colleges, and communities interested in exploring the adoption of the Fifth Dimension. The CD is entitled *An Incomplete Guide and Starter Kit for the 5th Dimension* (Institute for Research on Learning, 1998) with assistance from various members of the 5thD consortium and Marshworks design. The CD includes a video introduction of the 5thD, sections from project sites: ASU, Solana Beach, Magical Dimension, La Clase Magica, Whittier, San Marcos, Santa Barbara, and Torrey Pines along with video clips, photos, Quicktime VR panoramas, interviews, technology and software configurations, and other materials provided by the sites. Other components include a section on how to run a 5th Dimension site, with interviews from people involved in various 5thDs, FAQs, sample materials, text descriptions, and cross links to the

materials in the sites section. Topics include operating the actual club, working with the university, the 5thD class, working with the community, and local adaptation. A Cases section contains five video based case studies of interactions from Solana Beach and LCM. A supporting materials section porvides task/adventure/game cards, syllabi, course manuals, constitutions, maze documents, and how to manuals is also included.

Summary and Conclusions

The development and implementation of the Fifth Dimension Clearinghouse has been a three year process requiring participation at all levels in the activity system. The diffusion of this information is available for sites currently in operation as well as for potential adopters.

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Developing Reflective Practices of Preservice Teachers through a Video Assessment Program

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Abstract: Technology as basic as a camcorder and videotaped teaching episodes can serve as devices for reflective inquiry and self-assessment by preservice teachers during the student teaching semester. Carefully structured procedures in a video assessment program can assist preservice teachers in developing the pedagogical knowledge and skills necessary to effectively plan, implement, evaluate, and manage instruction. Adequate orientation and training in the program will enable preservice teachers to engage in the reflective processes of observing, analyzing, and evaluating their teaching performance. Carefully designed procedures can result in the videotaped teaching episodes being utilized as effective tools for the improvement of instruction rather than simply a souvenir or memento from the student teaching semester. This paper presents the Video Assessment Program employed in the Education Department of King's College. The Program has been a valuable tool for helping education majors make the transition from student to teacher.

Introduction

The importance of developing in new teachers the ability to reflect on their practice of teaching has been well-established (Schon, 1983; Posner, 1989; O'Donoghue, 1996). Several studies (Freiberg, Waxman & Houston, 1987; Freiberg & Waxman, 1988) indicate that reflecting upon teaching during student teaching can enhance the repertoire of pedagogical knowledge. Koorland, Tuckman, Wallat, Long, Thomson & Silverman (1985) state that self-assessment may be the key to creating better student teachers. Teacher education programs need to encourage preservice teachers to initiate self-assessment that will develop the type of reflection necessary for a prospective teacher to continually evaluate and modify instruction within the classroom.

Most preservice teachers rely on cooperating teachers and university supervisors for constructive feedback on their teaching. Observations and evaluations conducted by cooperating teachers and university supervisors are the most common sources of data during the student teaching experience. Unfortunately, due to the limited number of observations and conference sessions generally conducted, depending solely on outside sources for feedback on instruction may inhibit professional growth. Student teaching is the capstone event of the education program and it is extremely important for preservice teachers to receive as much feedback as possible during this experience. The data provided preservice teachers should be drawn

from a variety of sources to complement the feedback provided by college supervisors and cooperating teachers (Freiberg & Jerome, 1988).

Encouraging preservice teachers to effectively assess their own teaching will help them overcome weaknesses and maintain strengths. Preservice teachers are capable of analyzing their own teaching, want to improve their teaching skills, and would be willing to evaluate their own instruction if they had the resources (Oliva, 1988). Preservice teachers will be in a position to critique their own classroom instruction if they are provided appropriate background and experience.

In order for preservice teachers to effectively assess their own teaching, accurate data must be gathered. This data can be acquired through journals, logs, portfolios, audiotapes, and videotapes. Research supports the use of videotaped teaching episodes to foster self-assessment and enhance teaching performance (Sparks-Langer & Colton, 1991; Struyk, 1991; Struyk & McCoy, 1993; Blake, Foster & Hurley, 1996).

Simply videotaping preservice teachers and having them analyze their teaching without a systematic set of procedures or background and training in the process will be ineffective. Carefully structured procedures need to be established that can assist preservice teachers in developing the pedagogical knowledge and skills necessary to effectively plan, implement, evaluate, and manage instruction.

The King's College Video Assessment Program

The following information summarizes the process established at King's College to utilize a video assessment program in order to encourage reflection and self-assessment by preservice teachers. It has been developed to enable preservice teachers to engage in the reflective processes of observing, analyzing, and evaluating their teaching performance.

Brief History

Recording instruction delivered by King's College student teachers began in the early 1970's using an 8mm home movie camera. Although modern video technology is much more sophisticated, preservice teachers were still able to view their teaching and have a worthwhile discussion on effective instruction with the college supervisor. Nevertheless, early procedures did not provide a process for structured reflections about practice. Preservice teachers only had the opportunity to view their videotape at a scheduled conference with the college supervisor. They both viewed the teaching episode and had a general discussion on effective techniques observed and possible suggestions for improvement. Unfortunately, at this one and only conference, most preservice teachers were more concerned with their personal appearance and did not have the time necessary to effectively reflect on their teaching.

In the early 1990's, preservice teachers were given the videotape, asked to view it, and would then participate in a conference with the college supervisor. Although this was better than the previous method, preservice teachers were simply told to be prepared to "talk about" their videotape without being given strategies to analyze and reflect on their practice.

Since 1995, a structured process has been implemented that includes course-embedded instruction in effective teaching behaviors and appraisal systems, practice in analyzing videotaped teaching episodes, and opportunities for each student to be videotaped in field-based assignments and systematically reflect on their performance. These early experiences provide students with the background and knowledge for more effective reflection during the student teaching semester.

Course-Embedded Instruction on Reflection, Self-Assessment, and Videotaping

The research supports methods course-embedded instruction for self-assessment. A study by Jensen, Shepston, Connor, and Kilmer (1994) indicated that preservice teachers could benefit from more instructional experience with videotaping, self-assessment, and reflection in general. The more familiar students are with assessment measures and the more exposure they have to both self-assessment and assessment by supervising teachers, the more competent they will become (Thomson, 1992). Videotapes

have been used successfully in methods classes to provide feedback to students (Brasseur & Anderson, 1983). The use of videotaped teaching episodes as an instructional tool in teacher education methods classes prior to student teaching enables preservice teachers to be more self-confident and effective teachers (Skeel, 1989). Although elements of effective instruction are reviewed and discussed in all education classes at King's College, a more intense study of effective teaching and appraisal systems is undertaken in methods classes. Carefully developed inventories that are based on behaviors associated with effective instruction are examined. This information is linked with assessment activities conducted in the methods classes.

Former students have granted the Education Department permission to use their videotapes in education classes for instructional purposes. Methods class students view and analyze videotaped teaching episodes to compare with known principles of effective instruction. They are taught to assess procedures and consider alternatives, identify and offer changes for nonproductive routines, and think about ways to improve on the lesson.

Once students have become familiar with assessment terminology, the next logical step should be the implementation of the terminology in real class situations that are videotaped for self-assessment (Thomson, 1992). Education methods classes are sequenced and clustered in order to block time for team teaching and field-based experiences. Coordinated with methods classes (currently Language Arts, Social Studies, Mathematics, and Science) are field experiences that provide students with an opportunity to relate principles and theories learned in class with actual practice in schools and allow students to present lessons to students in elementary classrooms. During this field-based assignment, students (assigned in pairs) are videotaped at least once for each subject area and are required to complete reflection questionnaires for each episode. Methods class instructors view the videotape with the students and guide them in methods of self-assessment.

Although this process is time consuming for the instructor and students, early feedback on teaching skills during methods classes results in better preparation and success for student teaching (Rogers & Tucker, 1993). Students believe this instruction prepared them to effectively monitor their practices and make adjustments to them during the professional semester.

Student Teaching Semester

Preservice teachers participate in a fourteen-week, full-time student teaching semester in a local school district. They are generally assigned to one cooperating teacher who has completed workshops or classes in supervision provided by King's College. A full time college supervisor is also assigned for the entire experience.

The first three weeks of the professional semester are spent on campus for orientation activities. As a part of orientation, guidelines associated with effective instruction and self-assessment techniques that were examined and applied in methods classes are reviewed to encourage preservice teachers to make critical decisions regarding their instructional effectiveness. Preservice teachers also review the procedures and expectations of the Video Assessment Program.

Videotaping Procedures

Local school districts that accept King's College preservice teachers support the videotaping of instruction. The districts' only requirement is for permission slips to be sent home to parents/guardians prior to the taping. Students that did not return permission slips are kept out of camera view.

Availability of cameras is not an issue since the Education Department has three cameras, most schools have at least one, and many students have their own cameras. The cooperating teacher, another student teacher in the building, or the college supervisor, can conduct videotaping.

Preservice teachers are required to videotape a minimum of three lessons over the fourteen-week period. The first videotape is to be completed by week four, the second by week eight, and the final by week twelve. This timing and number of videotapings allow for early interventions and opportunities to assess growth and determine areas that need improvement.

Preservice teachers are advised to videotape a lesson that will give them an opportunity to analyze and reflect on the effects of their teaching. The length of time for the videotaping varies with the type of activity and grade level but normally runs from thirty to forty minutes.

Reflection Instrument

Preservice teachers complete the same reflection instrument used in methods classes. This instrument incorporates generally agreed upon language derived from the effective teaching literature that clearly describe observable teacher behaviors. The reflection instrument focuses on three major areas of instruction: Classroom Environment; Communication Skills; and, Teaching Procedures. The instrument contains specific items to be rated and open-ended questions that enable the individual to analyze and reflect on their practice, assess the effects of their teaching, and improve and refine their instruction. Preservice teachers rate specific behaviors as either Proficient (Effectively demonstrated the skill well above the required level), Satisfactory (Demonstrated a steady performance and effectively met the standard requirements), or Improvement Needed (Demonstrated some competencies but improvement required). An example of an item would be: "Activated students' prior knowledge and linked this to new information." Open-ended questions for each area (Classroom Environment, Communication Skills, and Teaching Procedures) include, "What do you perceive as the most positive aspects of your teaching procedures?" and, "In the area of classroom environment you are not satisfied with, briefly describe strategies you will consider for improvement." Two additional open-ended questions focus on growth and considerations for additional improvement: "In what specific areas of instructional skills or classroom techniques assessed in previous videotaped teaching episodes or observations have you shown improvement? Briefly describe how you accomplished this." And, "What specific areas of instructional skills or classroom techniques will you focus on for the next videotaped teaching episode or observation?"

Preservice teachers are directed to view the videotape at least three times to focus separately on each area when completing the instrument. The completed instrument is reviewed in conferences held with the college supervisor or cooperating teacher and serves as a guide for areas to focus on in the next videotape or observation.

Videotape Conferences

Preservice teachers have indicated that optimum learning from the videotape occurred when the student and college supervisor viewed the videotape together and discussed the assessment in the context of the lesson being watched. This dialogue between the student and supervisor provided a smoother transition between methods classes and student teaching, resulting in better understanding of the evaluation process and a more positive attitude toward the student teaching experience (Thomson). Moore (1988) found it imperative that the videotaped lesson is cooperatively analyzed by the preservice teacher and college supervisor.

The main purpose of the preservice teacher/college supervisor videotape conference is to promote the preservice teacher's ability to reflect upon his or her own teaching and guide them in considering their own methods for improving instruction. This conference gives preservice teachers time with the supervisor to verbally analyze their own practice and effects on students, generate alternative strategies to use, and commit to self-examination and self-improvement. A college supervisor/preservice teacher conference always follows the first and second videotaped teaching episode. The progress and ability of the preservice teacher determine a conference for the final videotape.

Most of the cooperating teachers that have been assigned King's College student teachers have completed a three credit, tuition-free graduate course, Supervision of Preservice Teachers. In this course they become familiar with the Video Assessment program and are encouraged to view the videotapes with the preservice teachers.

Through videotape conferences with the college supervisor and cooperating teacher, preservice teachers receive guidance and direction for reflecting on his or her practice. This is also a time for everyone to consider areas to be focused on in the next videotaping or observation.

Conclusion

It is clearly evident the time required by all individuals involved in this process is extensive. However, preservice teachers and college faculty consider the experience worth the time (Blake, Foster & Hurley, 1996).

Although the primary purpose of videotaping preservice teachers is for the improvement of instruction, the practice is also encouraged by national organizations. The National Board for Professional Teaching Standards (1987) requires candidates to submit a portfolio as part of the application process for national certification. It is suggested that candidates include in the portfolio four or five classroom-based exercises (may include videotape of classroom interaction or discussion) and written analysis of the teaching reflected in the videotape. If colleges of teacher education are going to prepare highly effective teachers who are capable of evaluating their teaching in the light of student learning, the time must be taken to provide education majors with the necessary training and experience in this process.

King's College places a high priority on developing a preservice teacher's ability to become a reflective practitioner. Time is committed to learning, experimentation, critical analysis, and practice of skills necessary to effectively reflect. The videotaped teaching episodes are utilized as effective tools for the improvement of instruction rather than simply a souvenir or memento from the student teaching semester. The King's College Education Department Video Assessment Program has been a valuable vehicle for helping education majors acquire the knowledge and skills required for professional development and a successful transition from student to teacher.

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Weaving the Web into the Classroom: An Evolution of Web Enhanced Instruction

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Abstract: This paper addresses a range of issues that teachers must consider when designing and developing a Web-enhanced course. It offers a guiding philosophy for Web-enhanced course design, presents a discussion of improved instruction and course management, outlines design issues that are involved for a course Web environment, and proposes the pedagogical benefits which can accrue for student and teacher. Students will become more active learners as they take responsibility as co-discoverers of knowledge. Instruction will improve as it becomes more flexible, relevant, and interactive. Course materials will evolve along with the supporting technology.

Introduction

Just as the technology of previous decades such as audiocassettes and videotapes has impacted the role of the classroom teacher, the growth of Web-based courses will have a major effect on the classroom (Dugan, 1998). For education, Web-based and Web-enhanced courses are one of the fastest growing areas on the World Wide Web (Kaplan, 1997). To keep pace, educators are faced with diverse and difficult challenges ranging from the technical to the pedagogical. This paper will discuss what two Web developers have learned and are continuing to learn about what may turn out to be the most revolutionary innovation since the invention of the printing press. The discussion of courses designed for the Web should be of interest to educators, regardless of discipline, who believe that technology can improve the way they teach and the way students learn.

An underlying goal of a Web enhanced course is to enable students to acquire the conceptual background and the online skills needed to achieve Internet competency and to awaken them to the Internet's incredible potential in education. The first major objective is to instruct students in the broad range of basic Internet services, such as email, listserv, telnet, FTP, and the WWW. A second objective is to challenge the students with innovative methods of course development and delivery via electronic means. The final thrust is to involve students in debate about the future of the Internet by discussing such issues as equity, privacy, security, censorship, and copyright.

As in any traditional course, students will continue to attend classes, listen to lectures, ask face-to-face questions, participate in individual and group projects (including hands-on computer exercises), and do homework. The learning enhancement is the opportunity to conduct research on the WWW, e-mail teachers and classmates, submit multimedia projects, practice critical thinking, and learn to "synergize" information in the

non-linear environment of the network. Additionally, education students will be able to design and implement their own Web pages to apply the pedagogical concepts and tools learned in the course.

This course is designed to be presented by an individual with moderate competence in the use of all of the technological tools the students will be required to learn, plus a working knowledge of Instructional Technology theory and practice. Instructional Technology involves the design, development, implementation, management and evaluation of processes and resources for learning. Because the course will change frequently, the teacher must be willing and able to learn to use the current and emerging crop of Internet tools. The course is designed to augment the skills of any undergraduate education student who expects to work in a school setting requiring interactions with modern information technology. A basic requirement is that every student has individual access to an Internet-connected PC and that each PC is equipped with the full range of software applications to be taught.

This Web-enhanced course has evolved from the initial version that merely placed print-based materials on the Internet, to later versions that included research projects and constructive activities such as student Web page creation. It is now directed to a future, fully interactive experience that will enable online testing with immediate feedback, concept building sessions, and an online discussion forum. The ultimate goal from the standpoint of teacher education is for both future and practicing teachers to understand how on a practical level the Internet can be interwoven into course development and implementation across all curriculums regardless of discipline or grade-level.

However, this wealth of activities manifests a range of issues that teachers must consider when designing and developing a Web-enhanced course. Several questions must be addressed.

- What is the guiding philosophy of Web-enhanced course design?
- Can the Web improve instruction and course management?
- What design issues are involved for a course Web environment?
- What additional pedagogical benefits accrue for student and teacher?

Each semester these questions should be revisited for appraisal based on student response to the course environment and technological advances. Ongoing student evaluations (via electronic means) and peer reaction provide two mechanisms of assessment that enable continuous quality improvement. This redesign is especially important since Web content and delivery is constantly evolving, as will be the Web knowledge base of incoming students.

Guiding Philosophy

Two inspirational "tales from school" provide initial motivation for laying a philosophical foundation. The first involves visualizing a 19th Century surgeon in a 20th Century operating room. The good doctor would literally be lost in a modern setting. Compare this image to a 19th Century teacher in a typical 20th Century classroom. With just a bit of content updating, the teacher would be ready to lecture in relative comfort, which is somewhat incongruous.

The second true story happened about 15 years ago in the Veterinary Program at Mississippi State University. Two students were having particular difficulty with a final exam. One student left the exam room, went to the library to research the answers, and came back to finish the exam. The second student merely made his best guess at answers he did not know. The outcome of the story was that the researching student was deemed to have cheated on his exam and was failed. The second student barely passed the exam. An illuminating question would be: Which vet would you want operating on your dog or cat--the one who researched the problem or the one who took his best guess? The next year the Veterinary Program required all students to own a laptop and have a connection to the Internet for research. The realization was that in any field with extensive information, research skills are more important than the ability to remember facts.

The two stories point to fundamental issues in education. Are teachers demonstrating skills that they expect students to learn, in particular, technical skills that we all agree are essential in an information-based society?

That is not to suggest that traditional skills such as oral and written communication should be neglected, just that we need competency with proven tools. More importantly, these navigation and application skills will contribute to the critical thinking and problem solving skills relevant to the digital domain and elsewhere. We want to help develop our students as self-directed learners who are comfortable with resources for problem solving. Rewards for exploring these resources must be built into the curriculum.

The second issue is one of learning models. Rather than view "the student as a vessel to be filled at regular intervals with knowledge," the Web-enhanced course should use as its learning model, "the student as a co-discoverer of knowledge with the teacher responsible for seeing that the discovery takes place." With this model the teacher and students will not be "strapped to a classroom if discovery can take place in different spaces, even cyberspace" (Ruth, 1997). Accelerated learning is not the goal; the computer is not a substitute teacher or a tutor with boundless patience. It is a personal access tool in an information rich milieu. Our courses must provide the impetus to master the new tools of the trade.

Improving Instruction and Course Management

Instruction is better if more efficient, more effective, or more appealing. Improvement on any of these three dimensions, without compromise to the others, yields better instruction. The following suggest how the Internet might improve instruction.

The Web appeals to students as a learning mode as it restores the intrinsic value in learning, i.e., *enjoyment*, as a more exploratory style is reinforced. The graphic imagery, the hyperlinked world, is both familiar as a style to the MTV generation and responsive to their curiosity. Additionally the creative aspect of building Web pages can provide the student with a positive, reinforcing experience. In even introductory classes Web page creation seems to appeal to students regardless of their personal interests or academic preparation. The students' personal Web sites provide a platform for their opinions, a gallery for their taste in art and music, an altar for their heroes and heroines. And through all of this creation and exploration, they are writing, connecting ideas, and with some guidance, becoming discerning.

More than ever before, the contemporary student is comfortable with technology and, in fact, expects it. Many of today's students are already using the Web for entertainment and peer communication, why not education? Unfortunately, in too many schools the token or ineffectual use of technology has not reflected its broad acceptance by today's young people.

The Web has been thought of as practical tool for distance education, helping students access educational resources without being in the classroom. It is also a way to give students, teachers, and administrators more flexibility, even in the traditional classroom. A set of basic course Web pages can be developed from existing materials if the educator is competent in the use of current word processing software. The development of "static" Webpages has become an end-user activity that can be easily learned due to the many good Web development software tools on the market. The teacher can make all class materials and resources readily available to any student at any time of the day or night, make easy adjustments and updates to assignments, and manage lesson information flow with less lead-time than a paper environment would provide.

The emergence of interactive Web modalities such as Active Server Pages with database backends provide the teacher an effective means of guiding and measuring individual student and class progress. These dynamic access and delivery methods can involve the student in a more active participation and provide for management of the feedback between student and teacher. The traditional, "static" Web page is used to deliver information and to provide links to other information sources. It cannot collect data such as student responses to a survey or quiz. It cannot record the pages accessed as the student navigates through an assignment. It cannot redirect the progress of a lesson in response to a student's entry in a tutorial or guided exercise. In contrast, an Active Server Page can store the student's responses in a database with the use of "forms" created in a word processor such as Word or contemporary database package, such as Access.

Active Server Pages could also be used to implement a guided lesson using control structures that the teacher can define, but this might require either some expertise on the part of the teacher or a third-party developer/vendor. The stumbling blocks to the use of the more sophisticated Active Web Pages have been the

difficulty of developing these pages by users who are primarily educators, not "techies," and the technical support that is needed at startup in the Web server environment. However, it can be reasonably expected that the software that supports Active Server Pages will soon be as easy to use as that which grade schoolers are using to develop their personal Web pages.

Web Enhanced Course Material Design

Designing materials to be viewed on a computer screen requires an awareness of the interrelation of visual composition and presentation to the student's understanding and motivation. Five principles of graphic user interface design that come into play for a Web environment are the use of metaphors, direct user manipulation, consistency and perceived stability, feedback dialog, and aesthetic integrity.

Since people have more experience in the real world than with computers, using metaphoric icons helps users more quickly learn basic navigation, and retain a sense of organization more readily. Just as Microsoft Windows incorporates the "desktop" metaphor, a Web site must have a predominate theme such as a site map of course materials or a "book" icon linked to a table of contents.

Users want to feel that they are in charge of the computer's activities. Telling users their options by providing visible choices and ways to make their choices are necessary design elements. Effective screens are both consistent within themselves and consistent with one another. The look, usage, and screen behavior should be the same throughout. Users feel comfortable in a computer environment that remains understandable and familiar rather than changing randomly. They need reference points that provide both visual and conceptual stability. Even as the environment changes, familiar landmarks provide an illusion of stability.

User activities, which may be complex if taken together, should be simple at any given moment. The user must be kept informed by immediate feedback. If an operation cannot be performed, or if there is an error, the user must know it. Visually confusing or unattractive displays detract from the effectiveness of human-computer interaction. As much as possible, commands, features, parameters, choices, navigational options, and data should appear as graphic objects on the screen.

Design must also consider the possibility that visual elements and non-discriminating choices can become a distraction in a learning environment if they do not support the primary objective of a particular educational activity. This possibility has to be weighed against the reinforcing value of overall enjoyment and the stimulation of the exploratory, free associative method. These are the questions that must be considered: What will the student absorb? How will the experience build their knowledge base, feed analytical processes, and stimulate creative reflection?

Pedagogical Benefits

Using the Internet to enhance a course involves a changing pedagogical paradigm. The first change is from seat or time based education to a lifelong learning model. Class attendance is far less important than learning a set of skills and concepts such as information acquisition, processing, and evaluation. The new paradigm might be termed "network learning" as opposed to classroom centered instruction or achievement based education. Students become part of a community of learners/scholars by participating in and contributing to the universal repository of knowledge. Of course, this learning model requires more independence and self-motivation, and some students do not consider themselves computer literate and can be intimidated by the online materials.

Just placing traditional course materials on the Web, by itself, does not add anything of pedagogical value. If students can simply print out the Web materials, the only gain is passing part of the paper budget from your department to the computer lab. The best way to evaluate whether value is added is to assess "the extent to which the material cannot be reproduced in the older medium" (Fraser, 1998).

Perhaps the most enjoyable reward of redesigning course delivery is the new personal challenge. The teacher becomes a learner along with the students. It also fits a responsive style, so that last minute updates are easy and

overall course material lead time is reduced. In this new paradigm, we need to change from being the "Sage on the Stage" to being the "Guide on the Side."

Critics of the technology-intensive model of course delivery state that it decreases the interaction between students and faculty. Encouraging the use of e-mail for "anytime, any place" questions can actually increase interaction, albeit asynchronously. In particular, shy students who would never raise a hand in class to ask a question or express an opinion, find e-mail an effective way to "speak up" and be part of the class discussion.

Conclusion

In a Web enhanced course students will continue to attend classes with traditional elements such as lectures, questions-and-answer sessions, and group projects . In learning to "synergize" information, students will acquire the lifelong skill of "knowledge navigation" and come to an awareness of the Web's importance in constructing the experience of education in an age of instant, global connectivity.

We must be patient with technology, even if at times it appears that it is not very patient with us. Computers are only 50 years old, the Web as we use it today, only five. In a 1985 keynote address to a national convention on computing in higher education, Nobel Laureate Herbert Simon pointed out that the impact of revolutionary inventions such as the railroad and computers takes time. It is not just time, but the effect of related inventions and the experience of using new technology that will determine the long-range effectiveness of its use. Simon suggested that computers can bring about a revolution in education only if their use is "accompanied by improvements in our understanding of teaching and learning (Kozna, 1991)." The Web may well become the launching pad for education in the 21st century, but the motivating interaction of student and teacher will continue to fuel the learning vehicle, and the creative leadership of educators must engineer its guidance system. To do this, future teachers, indeed today's practicing teachers, must be prepared for the new "space race" that will explore and expand the outer reaches of cyberspace as it interfaces with human intellect.

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Enhancing the Preservice Teacher Experience Through Technology Implementation

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Abstract: Future teachers need to be exposed to more than just a computer literacy course. As technology use expands in schools it is important for teacher education programs to implement technology into all program courses in an effort to train technology literate teachers. The purposes of this study were to expose preservice students to the use of technology in an activity based course and to gain insight into their attitudes and perspectives toward technology implementation. Technology implementation included electronic mail, videotaping, and use of the Internet. Students (n=40) used technology for a 16-week semester. Upon conclusion of the semester students' attitudes were measured through completion of an attitudinal survey, electronic communications, and focus group interviews.

Future teachers need to be exposed to more than just a computer literacy course. As technology use expands in schools it is important for teacher education programs to implement technology into all program courses in an effort to train technology literate teachers. Even though e-mail systems have been available on academic campuses for over a decade (Bull, Harris, Lloyd, & Short, 1989) many college students still do not possess knowledge of how to use e-mail. Telecommunications have been used to supplement instruction (Poling, 1994), connect students and to provide pedagogical support during early field experiences (LaMaster & Tannehill, 1997), introduce information technology as a teaching tool (Powers & Dutt-Doner, 1997), and aid in reflection (Stokes, 1997). These studies found that students' technology skills improved as they used telecommunications in their courses.

Recently, the National Center for Education Statistics (1996) revealed findings that 50% of U.S. public schools now have Internet capabilities. As students begin to use the Internet in schools it is increasingly important to have teachers experienced in this technology. It is critical that training teachers to navigate and use the Internet become a requirement in teacher education programs. Furthermore, preservice teachers need to be challenged beyond learning to navigate and locate resources. Ellery (1997) stated that "the World Wide Web can bring us closer together, make time-consuming tasks quicker, and more efficient, provide information, help us teach classes more effectively, and serve us professionally." Future teachers need opportunities to learn how to incorporate the vast amounts of current technology skills and information into their instruction.

Although the concept of using technology in teacher education classes is not unique. Implementation of technology into a physical education teacher education class occurs less frequently. While teacher education programs often offer a computer literacy course, seldom is the technology infused throughout the curriculum and used in activity based courses.

Video technology has been used to enhance the coaching environment for many years. Coaches have filmed their athletic concepts for later review, filmed skill sequences for analysis, and used video to market the talents of an athlete. Video has also been used in physical education classes to show students an example of model skill performance (Mohnsen & Thompson, 1997). The main advantage to videotape technology is the ability to replay the tapes immediately after a performance (Trinity & Annesi, 1996). Implementing videotape technology into a teacher education course allows students to experience practical application of video in teaching situations. Teaching the use of the video cameras, strategies for using video, and demonstrating management techniques when using the equipment are very important to create familiarity for students. Additionally, students can use video to observe and evaluate their teaching skills, critique sport skill

performance, or replay teaching sequences for data collection. Often video is used in isolation, but using the video during an activity class allowed for replication of a real teaching environment with real concerns about classroom management, equipment safety and transition tasks. The Internet has been used in teacher education courses for students to participate in WebQuest projects (LaMaster, Williams, & Knop, 1998). These projects allow students to explore the Internet in a participatory fashion aimed at exposing them to user skills. Teacher education programs need to continue to implement these Internet projects, yet elaborate on these introductory Internet skills.

It is important that preservice teachers extend their technology skills beyond simple computer literacy and be able to model technology skills. Teachers who are able to competently and enthusiastically demonstrate technology will be more likely to encourage their students to explore technology applications. Therefore, the purposes of this study were to expose preservice students to the use of technology in an activity based course and to gain insight into their attitudes and perspectives toward technology implementation.

Methods

Participants were 40 physical education teacher education students enrolled in an upper level practicum course focused on the development of pedagogical skills in an indoor activity setting. The nature of the class was not to teach the skills of indoor sports, but rather to provide practical experience and knowledge of pedagogical issues. Three different sources of technology were implemented and included electronic mail, videotaping, and use of the Internet. Traditionally, practicum courses were structured around game play and teaching, so introduction of these technologies and the accompanying skills was unique within the physical education teacher education curriculum. Very few of the students had previously experienced any of these technologies, particularly as a course requirement, and never in a course designed around activity.

In an effort to initiate student use of electronic mail, instructions were provided describing how to obtain a campus e-mail account. If students already had an account on another server they did not need a campus account. A one-day computer training session was embedded into the course to teach both the campus e-mail system and the Internet browser. E-mail tasks consisted of checking for mail, composing and sending messages, replying to an individual and the group, and creating mailboxes. Internet tasks consisted of using the browser search function, going to sites with known URL's, and creating bookmarks. All of the students participated in the session and had obtained e-mail accounts prior to the session. Before completion of the session each student had to e-mail a message to the professor. This accomplished two key concepts, first, it assured that students were able to send a message, and second the e-mail addresses were able to be captured and used to create a class mailing list. Throughout the semester e-mail was used to answer professor initiated questions, communicate tasks to students, and to supplement the instructional process. Students were encouraged to check their e-mail at least three times a week.

There were two skill analysis video projects during the semester. In addition to the skill analysis projects, each student was videotaped as they instructed a peer teach and as class participants. These projects provided an opportunity for each student to operate the camera in a teaching situation, wear a wireless microphone when teaching, and review themselves on tape. There were also two Internet projects during the semester. The first project allowed students to access a web site and explore the various components of the site. Once the students had navigated within the web site they were to critically examine the site for content, ease of use, and provide their opinion concerning value to physical education teachers. In addition to the critique students needed to locate two other sites which focused on indoor sports and describe why they selected the site. This project was very basic for the purpose of introducing the students to the Internet. The second project was more involved and required the use of search engines to access web sites and create a project that could be used with their future student populations.

Data Collection & Analysis

Data for this project was collected over two semesters and all students were required to complete the technology projects as part of the course. However, it was upon completion of the course subjects were first asked to volunteer to participate in the study. Once students had volunteered they were asked to release their e-mail communications and course projects to the researcher. Volunteers were also asked to complete a questionnaire and participate in a focus group. There was 100% voluntary participation in this study.

Four major data sources were collected throughout the 16-week semester and included electronic mail communications, course projects, questionnaire data, and focus group interviews. Electronic mail messages collected represented messages sent to the professor by students throughout the semester. Some of the messages were in response to a professor initiated message while others were unsolicited. Data concerning participant's attitudes and perceptions toward the use of electronic mail were collected using an attitudinal questionnaire (D'Souza, 1992). This survey consists of several statements, phrased both positively and negatively, to which students respond using a 5 point Likert scale. Focus groups, consisting of 4-6 participants, were used to obtain additional information concerning attitudes and perceptions toward the use of technology in the course. Each focus group had a peer facilitator and the session was tape recorded and later transcribed.

A grounded theory approach was used for data analysis (Bogdan & Biklen, 1998). Analysis included a thematic focus of student electronic mail messages. Transcripts from focus group interviews were also coded and thematically organized. Questionnaire data were statistically analyzed using SPSS (version 8.0). Course projects (video and Internet assignments) were used to confirm insights gained through other data sources.

Results

Upon completion of this course students were positive toward the implementation of technology. They were able to communicate using electronic mail. Their ability to use video increased dramatically throughout the semester and they were able to analyze and critique their teaching from the video format. Students' Internet skills improved greatly and were used to successfully complete a course project.

During the two semesters of data collection over 200 e-mail messages were received by the professor. This is impressive considering few of the students had prior e-mail experience. Content of the messages were categorized into five themes; answers to professor initiated questions, seeking information concerning upcoming projects, technology comments, rapport building, and other. The role of e-mail during these two semesters was considered an information supplement and therefore it was not surprising that the largest thematic category was answers to professor initiated questions. Most of the student responses were received within 2-3 days of the professor initiated posting and consisted of brief responses. The category of rapport building only included messages from a few students each semester.

Results from the questionnaires and focus groups indicate that student perceptions concerning technology implementation were positive for this course. Students agreed that e-mail was an effective way to disseminate class information. Additionally, students believed that e-mail provided them better access to the professor. "It made her always accessible you could always get in touch with her pretty quick". Another student stated "I liked it because you didn't have to go to her office or call her on the phone you could just e-mail her and you will get a response faster than if you went to her office". Survey data confirmed that students felt there were more interactions between themselves and the professor as a result of e-mail. However, they did not think e-mail made their peers more accessible. Students were in multiple courses together and found it easier to talk face to face rather than use e-mail. When asked whether e-mail increased their motivation to the course student response was neutral. This is logical considering the focus of the course was activity, not technology, and that e-mail was used to supplement instruction.

Insights concerning the implementation of video and the Internet were gained from focus group interactions. Students overwhelmingly agreed that video analysis was a great way to assess skill and teaching performances. One student commented "I liked the videotaping because I thought it was cool that you could slow-mo through the whole technique and watch every aspect to see what you are doing wrong". One student did feel that using video was unrealistic in public schools with large numbers of students. Several of the other students were quick to offer alternative ways to use videotaping with large groups. All students agreed that videotaping experiences

should remain an aspect of the activity based course. Reactions to the use of the Internet were mixed. Many believed that the information on the Internet was valuable, while others believed the amount of time spent on the projects did not equal the benefits gained. Focus group statements from students indicated an appreciation of the value for technology implementation in this course. Students were able to identify multiple benefits and insights concerning their future teaching and the use of technology with their students.

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Pedagogically Appropriate Integration of Informational Technology in an Elementary Preservice Teacher Education Program

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Abstract: This paper describes ways in which preservice students in an elementary education four-year degree program learn about and learn with informational technology. Students learn specific skills and concepts related to informational technology and its uses and application to the classroom in specific ways at different stages of the program. Also discussed in the paper is the evolving faculty inservice to reskill or retool our instructors to enable them to provide meaningful informational technology experiences for students. One particular experiment is outlined, an experiment that addresses the content of and response to a specific set of Informational Technology modules implemented in a Faculty of Education to ensure that ALL students complete their Education degree with a mandatory set of technology concepts and skills, in a faculty where there is no mandatory Computers in Education class. The paper also describes a vision of the IT future for our faculty and students.

Introduction

The authors work together in an elementary teacher education program. Vi teaches Mathematics Education, Nancy teaches Arts Education, and Liz teaches Education Professional Studies, a class focused on generic teaching methods and integration of all subject area classes. We strive to integrate technology in a natural and contextually-relevant manner into our specific curriculum areas. However, we know that the students need much more exposure to rich pedagogically-appropriate technological environments than we can possibly provide in our individual classes. Over the past five years we have worked through a variety of plans to ensure that students in the program become familiar with how to use technology effectively and appropriately in the classroom (see Maeers, Browne & Cooper, 1997).

This past year we developed a template which outlined all the IT concepts and skill areas that we felt students needed for teaching and the mandatory classes which offer some of these areas. There were many IT concepts and skill areas not accounted for in any of the classes. Attached to one of the classes (the Educational Professional Studies class) was a two-semester hour seminar, which was compulsory for all students in elementary education. Traditionally, this seminar focused on current educational issues and ideas. During the 1998-99 academic year we decided to introduce into this seminar some experimental informational technology modules, which will be described later in the paper. However, even this was not sufficient. In addition to what the students would receive in these modules, it was important that they saw IT modeled effectively in other classes. That meant that faculty who taught the elementary preservice teachers were encouraged to use (a) electronic presentation software in the delivery of some of their classes, (b) the internet and its resources as they were relevant to the content being worked with, (c) subject area software as it applied to the topic under discussion, and (d) e-mail communication as a natural way to communicate with students. These IT demands put tremendous pressure both on the faculty responsible for the IT modules and for all faculty to integrate IT into their classes.

Why Focus on Technology Integration?

In the above we have described the need to find opportunities in the program for the inclusion and integration of informational technology such that students learn about it and about how to use if effectively and appropriately in teaching. However, the question that arises is why--why are we trying to do this, why bother? Why not simply offer one Computer in Education elective class and have some of the students graduate with a solid IT skill and content knowledge base?

Rationale for Decisions to Include IT for Every Elementary Preservice Teacher

We focus on technology integration and on helping our students create rich technological classroom environments for the following reasons:

1. *Availability and currency of resources*

There is a wealth of computer-related technology resources for all subject areas. Our preservice teachers need to know how to access these resources, how to evaluate them, how to discriminate the appropriate from the inappropriate, and how to integrate these resources effectively into curriculum-related classroom activity.

2. *Employers of teachers want new teachers who are computer literate*

Schools are acquiring more and more computers, many of them with internet capability. When hiring, school divisions are looking to new teacher graduates to provide in-school inservice for teachers, to teach children how to use the computer, and to lead schools, districts, and regions into the next millenium. Thus, there is tremendous pressure on faculties of education to create computer-literacy opportunities for graduating teachers. To be able to create and provide these opportunities, faculties of education need to be able to model effective use of technology in teaching.

3. *The on-line provincial curriculum*

The curricula for our province in Canada is now completely on-line for every subject for all grade levels. It is located at http://www.sasked.gov.sk.ca/docs/evergrn.html (Evergreen Curriculum). Additions and changes to curricula are currently made on-line. Hard copy curriculum guides will soon cease to exist or will exist only in the last printed version. It is important to know about the content of the provincial curricula, how that content is organized, how to search the data base, and about all the other resources that are available on-line for teachers; teachers need to be aware of all these resources, but so also do our preservice teachers who are now preparing lessons for practice teaching, and who will soon be seeking employment in the province.

4. *Informational technology methods*

Students could take IT workshops from a local college, or they could take a university computer science class, but neither of these would familiarize students with how to use technology for teaching. Certainly, students need to know IT skills, many of which can be learned through independent workshops. But where would students learn how to use computers in thoughtful ways, in pedagogically appropriate ways? Where would they learn how to evaluate programs and websites, where would they see modeled for them good teaching using technology, where would they learn how to integrate technology into their teaching and create rich technological environments where children could learn *with* technology?

Our students need to be critically aware of resources available through an electronic medium, they need to know about the demands of the field, both in hiring and in field expectations, and they need to know how to thoughtfully and appropriately use, and incorporate resources from, the Evergreen Curriculum into lessons and activities for classrooms. While we realize that our students need to know *about* technology and about *what* technology can provide, they also need to be able to *critically evaluate* and *discriminate* what (technological) resource to use, and whether one should be used at all. They need to be able to understand *conceptually and in pedagogically-appropriate ways*, how, where and why to use computer-related technologies.

Frameworks for Our Work

The programs within our Faculty of Education (Elementary, Secondary, Arts Education, Human Resource Development, Baccalauréat en éducation) are based on constructivist learning theory, on natural integration of subject areas, on a resource-based principle, and on active learning. This is particularly true in the Elementary Program, where the students are learning how to teach young children (Kindergarten through Grade 5 and Grades 6--9).

We could apply a number of learning theories and belief systems to our story of (experimental) institutional-technological change. Primarily, we are a faculty who work together to make change in caring, thoughtful ways, and who engage in collaborative endeavors, collaborative partnerships with other institutions, with the field, and collaborative research--usually with colleagues we work and teach with (Christiansen, Goulet, Krentz, & Maeers, 1996). Introducing the new into our program is, in our faculty, an

ongoing collaborative endeavor. Collaboration, to be successful, requires talking and listening, and generally engaging in dialogue or conversation. In a true conversation there is a topic, in our case the topic of meeting the challenge of ensuring that ALL students graduate with IT pedagogical competencies.

People engage in conversation around the topic to work out different strategies to solve the problem. No one person has the answer, no one person has the truth. If there is an answer or a truth it resides within the collaborative conversation. We benefit from each other's contributions. The students benefit from the final product of that conversation. In-depth conversation about a topic or challenge such as we faced takes a tremendous amount of time, time that takes us away from other work (e.g., writing for refereed journals--upon which promotion is judged). The manner in which we met the challenge of developing an IT inclusive teacher education evolved within an environment of sharing and caring, and of conversation as the vehicle of collaboration. This environment was itself an extension of a long story of invisible work (Kapuscinski, P., Browne, N., Krentz, C., Cooper, E., & Goulet, L., 1995) for institutional change.

The cognitive apprenticeship model of learning, described by Brown, Collins & Duguid (1989), which emerges from social constructivist theory (Ernest, 1991) forms a framework for our modules and the integration of technology into our teaching and learning. We assume that people work together and learn from each other, mentor each other, and grow together towards a final goal. Each person must learn for him or her self, no one can learn for another, and that learning best occurs with an environment of shared trust, where participants can experiment with their 'world', interact with each other and with the topic as they learn, and where personal knowledge emerges from testing the reality of their experimenting with the 'world' against the response they get from experimentation.

We also use a mathematical learning model applied to technological learning. This model, originally developed by Kieren and Pirie (1991), and later adapted by Maeers, Browne and Cooper (1997), demonstrates that each individual has a starting place of "Ethnotechnological Knowledge" (ET), a place defined by one's culture, previous experience with computers, and previous opportunities to become computer-literate. From an ET beginning learners' IT competency evolves through specific doing, through experimenting actively with rich computer-related experiences. In this stage "Concept Making" (CM), learners cannot yet make a plan of action for themselves, but are dependent on instructions and support. In the next stage "Concept Organization" (CO) learners can relate their CM activities, develop a mental image of where they're going, make a plan of action and execute it. CO activity is goal-directed, although the route taken to reach that goal may still be inefficient and haphazard. The next stage of the technological learning model is called "Analytic Processing" (AP). Here learners can evaluate and select appropriate tools, explain procedures and state why they made certain decisions. Here they can integrate technology into their lessons and work appropriately with technology in the classroom. The AP stage is really the beginning of pedagogically-appropriate activity and this is the stage we want our preservice teachers to reach. Beyond this stage, which we have not fully developed yet, one would find an experimental programming stage, a creative web design stage, and stages that we cannot yet imagine. In all of the above stages there is fluidity. When one reaches CO that does not mean that this stage has been attained for all IT concepts. Individuals move back and forth between the stages with each new area of IT learning. The most important stage, we feel, is the concept making stage; here is where students (and faculty) need multiple opportunities to interact with their computer world, with support, encouragement, models, and conversation. Preservice teachers need to work at the CM stage within an environment which is supportive of pedagogically-appropriate practice. Not only are the students learning how to use technology for themselves, they are learning how to use it for teaching and learning purposes.

Informational Technology Modules--an Experiment in Institutional Change

We decided as a program group, on an experimental basis, to take five seminar time slots from each semester and devote these seminars to informational technology topics. The following summarized topics were offered to students during the Fall 1998 semester:

Module #1:

- review of Eudora Mail
- sending messages, establishing distribution groups for discussion purposes
- discussion groups and individual report based on a recent three-day outdoor education experience

Module #2:

- exploration of the Evergreen Curriculum (Saskatchewan's on-line curriculum)

- scavenger hunt on the curriculum

Module #3:
- demonstration of how to evaluate a site
- exploration of web-evaluation tools
- opportunity to evaluate a site

Module #4:
- using the web tools of Visual Page to create a personal website that can be stored on the Faculty of Education site
- creating the framework for a personal/professional portfolio

Module #5:
- exploring a WebQuest designed by faculty and discussing/evaluating the concept of a WebQuest in order to prepare for designing one next semester
- this WebQuest is called "Celebrating Nunavut" and can be found on the Faculty of Education home page at http://www.uregina.ca/educ

The Fall 1998 IT modules were skill-based and enabled students (and faculty) to acquire the IT skills and concepts necessary to use technology in pedagogically-appropriate ways. The series of IT modules planned for the Winter 1999 semester focuses more on how to integrate technology into the classroom learning environment. The hope is that the students would plan and implement these ideas in the field-based experience during the semester.

Faculty Inservice

In all new initiatives there is the need for training, for reskilling or retooling our instructors to assume roles of teaching about and teaching with technology, specifically with regard to the IT modules. As the content is to be integrated with other subject areas it was important that faculty understand the content and pedagogical implications of the above modules so that they could either teach the modules directly to their students, or assist in the teaching.

Vi was put in charge of organizing the content of the modules and for scheduling the seminar groups into computer lab time, hiring a senior student, and providing faculty inservice. We invited all the EPS faculty to attend the training sessions. They all came to all sessions--the first one was held on a Saturday morning. This training session was a non-example of efficient use of computer lab time. Everything went wrong. First of all, the faculty could not log on to their accounts in the computer lab because they couldn't recall their IDs and passwords. We had a two-hour work session planned and after 1 1/2 hours we were 15 minutes into the plan for the day. There were many frustrations and we were afraid that faculty would simply give up and walk out. But we laughed a lot, provided more coffee and cake, and got everyone over the obstacles of lab access, a very real experience for all of our students every year, and an experience that faculty are usually spared. We then experienced another obstacle: The Saskatchewan Education website which we were to visit that morning to explore the on-line curriculum, was down for upgrading. We couldn't reach it at all. Luckily, we had activities for module # 3 ready so we progressed to web evaluation. We debriefed this experience with the faculty group at the workshop and discussed how the unexpected often derails our plans, we modeled good problem solving strategies, patience, humor, and discussed how our experience that Saturday morning was a realistic flavor of "life in the lab." From an efficiency analysis perspective, our workshop might have been considered a disaster. By the end of the workshop, however, the faculty who attended were very appreciative of this "real-life" experience. People new to the world of IT learned from those a little more experienced; all faculty saw the seminar leaders (at least appearing) to be unperturbed by the obstacles, they saw us manage and problem solve the situation quite well, they saw how the experienced and the inexperienced could work side by side and learn from each other. Everyone asked questions and contributed to the conversation. In general, this workshop was considered a confidence-building situation.

During each faculty inservice we began with a short report from each instructor as to what occurred during the last IT module; did everything work well?; did the students understand the concepts and skills?; was the instructor able to teach what needed to be taught or what was his/her role?; what role did the senior student play?, and so on. Everyone was quite excited both about the level of learning from the students and

about their own personal learning. In addition to our regular meetings and training sessions we frequently met for hallway chats about the progress of everyone involved in the modules. The senior student was delighted with his learning about teaching adult students (his previous experience had been working with high school students). Through our almost continual conversation (both informally in the hall, and formally at program meetings, EPS meetings and our regular training session meetings) about the content and delivery of these five modules, we all felt very comfortable in our ability to offer them again next year, perhaps without the help of a senior student. At the time of writing this paper we are about to start our training sessions for the Winter 1999 modules and each faculty member has expressed the desire to assume more ownership of the content and leadership in the delivery. If we had tried to launch a series of workshops to train the faculty in IT issues we couldn't have hoped to be more successful. It is just possible, however, that some of our faculty would not be as interested in learning about the IT issues if teaching these issues was not imminent. It is sometimes in the learning how to teach it that we learn it--certainly with a deeper understanding.

It is evident that we cannot learn everything about technology, or about how to use technology in the classroom in five short modules each semester. However, if we can work with students and each other in a caring, friendly, collaborative manner, learning from them as we teach them, enabling them to learn using sound methods, good examples and allowing a lot of hands-on experimentation we may be able to get our students over the tough learning curve of learning about technology to learning how to use technology in caring thoughtful ways in the classroom.

Pedagogical Uses of Informational Technology in Teacher Education

The following are some of the ways that students who have taken the five modules in the Elementary Program are using IT in pedagogically-appropriate ways.

1. **E-mail**
   - discussion groups for discussing topics presented by the instructor, or ones which emerge from class readings
   - in-class distribution groups (mini listservs)
2. **The on-line curriculum**
   - using the on-line provincial curriculum for lesson/unit planning
   - searching the data base to find resources
   - support for all curriculum classes.
3. **WebQuests**
   - creating WebQuests based on the curriculum
   - a WebQuest incorporates the concept of cooperative groups and using the web as a research tool for curriculum-related purposes
4. **Software**
   - familiarization with subject-specific software and how to use this software appropriately in the creation of rich classroom learning environments.
5. **Website--electronic portfolio development**
   - personal and professional website development and the creation of electronic portfolios to present themselves to future employers
   - samples of lesson and unit plans can be posed on the site
   - WebQuests can also be posted

Our IT Future Vision

We can only imagine what will be possible a few years from now. Based on our current knowledge and computer hardware and software capabilities we have considered what we would like to do with IT in our program. Our goals can be framed by the following topics:

1. **Diversity and equity issues**
   - using e-mail to connect with people from other cultures who share common concerns

- having e-pals or key-pals who would be considered experts in a specific area (e.g., child poverty) and conducting individual and group e-mail discussions with these people

2. **Continued curriculum support**
   - students should feel comfortable going to professionally-oriented sites, to on-line professional organizations, to on-line art galleries and evaluate, discriminate and integrate appropriate resources
3. **Continued (more sophisticated) WebQuest development**
   - the concept of a WebQuest will evolve and students can incorporate new WebQuest features into their creations
   - students can create multiple WebQuests and post them on their website
4. **Continued electronic portfolio development**
   - as webpage design tools become easier to use and more sophisticated so also will student webpage creations
   - the concept of an electronic portfolio to present yourself to the world (of hiring agencies) will evolve to include new features Ongoing faculty inservice
5. **WebCT course development**
   - some course, or parts of courses, can be developed using WebCT so that students who live many miles away can take the course on-line
6. **Faculty of Education homepage**
   - this homepage is quickly taking shape and will include sections for students to post their webpages and to post their WebQuests
   - there will also be program and subject area links and places for each subject area to present its courses and assignments

Summary

We're striving to move beyond the technical aspects of computers and to encourage our students to consider the integration of pedagogically-appropriate uses of technology. This is a real challenge for faculty members who completed their own formal education at least a decade ago. The experience of working with these new ideas has confirmed for us the importance of conversation as a means of effective institutional change. We are reminded again of the amount of work (intensive and often invisible) required for program change. At the same time we celebrate our own growth and enjoy observing the technological advances of our students. We are fortunate to work in a faculty where collaboration and change are the institutional norm.

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Pathways for Inquiry: A Text and Companion Web Site for Self-Directed Learning

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Abstract: Pathways for Inquiry is a web site that suggests and illustrates ways of selecting a focus for inquiry, asking questions, finding resources, and organizing and making sense of collected data. This paper describes the web site's content and reports its evaluation by 120 students who were required to use the site while enrolled, during the Fall 1998 semester, in a course on inquiry processes in a preserve elementary teacher education program. Student evaluations of the usefulness of the web site's several sections in guiding their own inquiries were obtained via a term's end survey which also solicited recommendations for the web site's development --- recommendations that have implications for how to craft the site's companion textbook to best complement the web site. Also discussed are analyses of students' inquiry notebooks for their use of various question and resource types, and gaphic organizers, at mid-term and term's end during their inquiries.

1. Introduction

Inquiry may be defined as the search for information, the development of knowledge, and ultimately, the realization of truth --- methods of searching and exploring that each field of study uses to explore characteristics and dimensions of the natural world and human experience germane to its disciplinary interests. The inquiry processes that John Dewey (1933) advocated as a framework for the education of self-directed learners seem especially critical at the turn of the 21st century with the deluge of information, the increasing speed of its transmission, and the need for vigilant searching for the credible and true. A compelling curriculum question asks what inquiry processes teachers need to know about, which they need to know how to use, and how to help them develop that knowledge.

Whitin & Whitin (1997) talk about scientific inquiry as starting with observing, which leads to questioning, followed by reflecting on personal strategies, then to collaborative sharing of strategies, for thinking through real problems. Short and her associates (1996) draw from the authoring cycle used by writers, in which the inquirers build from their knowledge to find questions for inquiry, gain new perspectives, look for differences in meaning, share what is learned, plan new inquiries, and create narrative and lyric representations of what they have learned.

Yet another way to understand inquiry is to think about its processes as critical thinking. Clarke and Biddle (1993) suggest a cycle that moves from concrete to abstract ways of thinking: from data generating processes to data analysis, then on to theory building, followed by theory testing which leads back to generating new data.

When the faculty at The University of Texas at San Antonio planned an interdisciplinary preservice elementary teacher education program, we chose to include a required course in inquiry: Modes of Inquiry Across the Fields of Study. The course meets Texas state standards (ExCET objectives) for teacher preparation in ways of knowing and higher-order thinking, as foundation for guiding the development of children's thinking, and to develop prospective teachers' abilities to engage children in inquiry learning across the curriculum, in ways that are true to the spirit of standards for elementary education published by national professional associations, notably the National Academy of Sciences (1996) the National Council for the Social Studies (1994), the National Council of Teachers of English (1996), and the National Council of Teachers of Mathematics (1989).

Modes of Inquiry Across the Fields of Study is an overview course that studies methodologies for generating knowledge in several fields of study: the natural sciences and mathematics, the social sciences, the literary arts, and the fine and performing arts, and requires students to conduct their own open inquiry into a topic of personal interest for which many types of resources are accessible. All faculty teaching the course follow a common syllabus which can be found at <www.martinello.net> and in which the required Inquiry Project is described.

Since the summer of 1990, when the course was first offered, the faculty teaching Modes of Inquiry Across the Fields of Study have been concerned about students' difficulties with the Inquiry Project. The faculty's collective

assessment of hundreds of students identified these problems: (1) difficulty in knowing how to begin an inquiry, i.e, to find and keep a focus for sustained study; (2) limited skills in formulating questions that would focus and guide their research; (3) unfamiliarity with the wide variety of readily accessible and reliable resources for their inquiry; (4) uncertainty about how to organize collected data to find meaningful patterns; and (5) the tendency to sustain an inquiry at superficial levels, emphasizing a widening rather than a deepening of the search. We realized that our students needed help with some of the most basic elements in inquiry before they could support inquiry learning for children they would teach.

1.1 Learning To Become An Inquirer

Studies of how experts inquire (Hawkins, Mawby & Ghitman, 1993) have uncovered several dimensions of critical inquiry: Focus and motivation; questioning and problem definition; methods and tools; use of resources; social processes; attention to audience; and closure. The inquirers they interviewed consistently spoke about the importance of exploring topics they really cared about and staying focused. They also stressed the importance of formulating and rephrasing questions so that they could more precisely define what they wanted to understand. They described their methods of organizing their inquiries, and they defined their purposes as searching for patterns and finding ways to communicate their findings to others. These master inquirers highlighted the importance of quality resources for conducting their searches.

The self-reports of master inquirers such as those summarized above, and others reported by John-Steiner (1994) and in Wallace & Gruber (1989), and in Martinello, Cook, and Woodson (1998), suggest some common elements of critical and creative thinking:

- Formulating and Refining Questions
- Searching for and Consulting Resources
- Collecting and Organizing Information for Analysis
- Deepening the Search
- Creating Syntheses of Findings

These categories match the needs of our undergraduates and became the focus of a web site to guide their work on the Inquiry Project for Modes of Inquiry Across the Fields of Study.

1.2 Pathways for Inquiry

The problems of meeting the learning needs of a commuter population of busy students, juggling college with work and family responsibilities, are well known. We needed self-help materials that could guide our students through the inquiry process. A specially prepared text seemed indicated --- one that students can use as a handbook and guide while they were researching their topics. But examples were also needed, and good ones include images that, if printed, can increase textbook costs beyond the affordable, given the collection of useful texts already in place for the course. A web site seemed the ideal companion to the text, offering twenty-four hour accessibility and an easy way to deliver many different forms of graphic illustrations. For these reasons Pathways for Inquiry at <www.martinello.net> was created.

Pathways for Inquiry contains the following sections:

Finding a Focus for Inquiry: How Do I Begin?
Beginning Questions: What Do I Ask?
Resources for Inquiry: Where Are The Clues?
Organizing and Making Sense of Clues: What Does It All Mean?

Additional sections under construction include:

Theory Building and Testing
Synthesis: Constructing and Sharing Knowledge

2. The Study
2.1 The Questions

With four substantive sections of the web site accessible to all students enrolled in Modes of Inquiry Across the Fields of Study during the Fall 1998 semester, it became feasible to require its use as a "course reading" several

times during the semester. I wondered, How would students respond? Would they use the site? To what degree? Hence, this study.

Questions about student perceptions of the web site that lend themselves well to a survey include: How much use do students enrolled in Modes of Inquiry Across the Fields of Study make of the web site, Pathways for Inquiry? How useful do students find the components of *Pathways for Inquiry* in helping them complete their inquiry projects?

Questions that explore changes in student development of inquiry skills are: What changes occur in their questioning during the course? What changes occur in their use of resource types for their inquiry projects during the course?

2.2 The Method

The subjects are one hundred and twenty students enrolled in five sections of Modes of Inquiry Across the Fields of Study, each with different instructors, during the Fall 1998 semester. The students are expected to visit the web site, *Pathways for Inquiry*, during the semester, for help with question formulation, and in identifying resources germane to their individually selected topics for open-ended inquiry. During the last week of classes, a survey was administered anonymously to all students asking about:

The degree to which they used the web site and the helpfulness of its sections to their inquiry including:

HOW DO I BEGIN?: Finding a Focus for Inquiry
A Story of an Inquiry: Ready Lady's Story (An Inquiry Notebook)
Inquiry as Detective Work: The Case of the Carousel
The Search for Emma's Story (web site version)
Worksheet for Finding a Topic for Inquiry

WHAT DO I ASK?: Beginning Questions
Formulating Probing Questions
Questions that Study Anomalies or Unexpected Events and/or Discrepancies
Questions Formed From Evaluative Thoughts About the Topic Under Study?
Questions that Test Hypotheses and Hunches
Questions Prompted by Interdisciplinary Thinking
Promising Questions For Inquiry
Using Question Stems
Developing Question Sets and Sequences
Keeping an Inquiry Notebook
Some Terms for Talking About Thinking

WHERE ARE THE CLUES?: Finding and Using Resources for Inquiry
Books, Magazines, Journals and Newspapers
Documents, Flyers, Catalogs, and Brochures
Personal Papers
Visuals
Audiovisuals
Objects and Artifacts
Technology
Places
People and Interview Data
Experiments
Guidelines to Organize Your Search

WHAT DOES IT ALL MEAN?: Organizing and Making Sense of Clues
Comparative Charts
Picture Glossaries
Cutaways

Cross-sections
Semantic Maps
Venn Diagrams
Matrices
Webs
Concept Maps
Branching Diagrams
Time Lines
Story Maps
KWHL Charts
Graphs
Advancing Your Search With Graphics

Also included in the survey are requests for an overall assessment of the web site's usefulness for their Inquiry Projects, and suggestions for what students would like to see included at the web site that would help them with their Inquiry Projects.

The students also kept individual inquiry notebooks in which they recorded how their inquiries developed over the semester. Their entries were transcribed into inquiry script format to diagram the sequence of questions formulated, resources consulted, clues uncovered, graphic organizers used, and new questions formulated, etc. This provided a map of the development of their inquiries. Individual questions and resources were then categorized by type. The development of questions and resource use was examined for change from mid-term to term's end.

2.3 Findings

At the time of this writing, the data are being collected and analyzed. A compilation of 120 students' responses to the web site survey will report:

- time they spent at the web site and use of sections of *Pathways for Inquiry*;
- their views of the usefulness of the web site's several sections for their inquiry projects;
- their recommendations for web site development;
- implications for the respective content of a web site and complementary textbook.

The data from students' two notebook submissions will be compared for:

- changes in student question sequences over time; and
- changes in student use of resource types over time
- evidence of use of graphics to organize collected data.

These analyses will be reported during the SITE 99 conference.

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Integration of Technology into Higher Education Teacher Preparation Programs

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Abstract: This paper reports on a study of issues teacher educators face as they attempt to integrate technology into their instructional program: (1) the support they receive for use of technology, (2) their expectations of students to use technology, (3) their personal use technology, (4) their knowledge of national, state, and local technology standards and requirements, and (5) their integration of technology standards into their instructional practice. Areas of strength and areas of need for integration of ISTE Foundation Standards into teacher education programs were identified.

Introduction

Educational reform or restructuring has been a major theme in the United States for the last 30 years. Educators and others believe schools need to rethink the current system in light of the changes taking place in society (Gonzales & Roblyer, 1996). At the same time, ongoing research about teaching and learning has provided new knowledge and understanding of how people learn. Students no longer need to just learn how to memorize facts; they need to learn how to find and process information. A shift in the learning process from isolated individual work to collaborative work groups is needed. In this environment, knowledge is acquired from exploration and critical examination of information rather than primarily from teachers and textbooks. Technology, when used as a tool, has the capacity to help students solve problems, think independently and collaborate with others and plays an important role in the new methods of teaching and learning (Office of Technology Assessment, 1989; Sheingold, Martin, & Endreweit, 1987).

Research on effective use of computers as well as new knowledge about learning has led to changes in how computers are used in education. In the 1980s most teaching was about computer science topics, such as operating systems and programming. Computers were used mainly for drill and practice activities and/or electronic flash cards. In the 1990s when research showed technology had the greatest impact on student achievement when used in a collaborative, student-centered environment, the focus shifted to curriculum integration and the use of computers and technology as tools to support learning (Sheingold, Martin, & Endreweit, 1987).

A National Council for Accreditation of Teacher Education (NCATE) report suggests that new skills needed in the workplace have been a catalyst for K-12 schools to put an increased emphasis on using technology. An increased number of computers in the schools affect the culture of the school and traditional classroom practice. The report notes a decline of computer to student ratios from "50:1 in 1985 to 20:1 in 1990 to an estimated 9:1 in 1997" (NCATE Task Force on Technology and Teacher Education, 1997, p. 3). However, technology in schools is greatly underutilized (U.S. Congress, 1995).

In recent years, there has been growing recognition that changes in teacher preparation programs are needed to support education reform efforts, including the integration of technology into the curriculum. To adequately train teachers to use technology, it must be integrated into all aspects of the teacher preparation program. Because people teach the way they were taught, teacher educators need to change the way they teach and model appropriate use of technology (Goodlad, 1994). Faculty who integrate technology into their teaching and learning will be more productive while they will also be developing new models for teaching.

The International Society for Technology in Education (ISTE) developed technology program standards which include recommended Foundations in Technology for all Teachers (ISTE Foundation Standards) (Thomas, Friske, Knezek, Taylor, & Wiebe, 1997). The ISTE Foundation Standards are divided into three performance based components: (A) Basic Computer/Technology Operations and Concepts, (B) Personal and Professional Use of Technology, and (C) Application of Technology in Instruction (see Appendix B). The

National Council for Accreditation of Teacher Education has adopted the ISTE Foundation Standards, along with the technology program standards (Thomas et al., 1997).

The National Council for Accreditation of Teacher Education (NCATE), the only national teacher education accreditation organization, adopted the ISTE technology standards as part of their accreditation standards. Two types of standards apply to the NCATE accreditation process: (1) curriculum guidelines and (2) unit guidelines for professional education programs. Schools/colleges of education seeking NCATE accreditation use the guidelines to "develop a folio that addresses the performance-based standards in each matrix" (Thomas et al. 1997, p. 1).

The NCATE Unit Guidelines are used to evaluate the integration of technology in teacher education programs. The ISTE Recommended Foundations in Technology for all Teachers can be used as guidelines for what teachers should know and be able to do, as well as, a guide for evaluating the technology component of teacher education programs. States have developed and continue to develop standards for teacher use of technology in education. Some states require evidence of performance of ISTE Foundation Standards to determine if graduates of teacher education programs are prepared to incorporate technology into their classrooms.

In 1997, NCATE took a more active role in the development of comprehensive technology guidelines. A Task Force on Technology and Teacher Education was convened to assist with "the development and implementation of technology expectations for teacher candidates and for accredited schools of education" (NCATE Task Force on Technology & Teacher Education, 1997, p. 3).

Method

Population

The population was 153 teacher educators who were integrally involved in preservice teacher education programs in 12 colleges/schools of education in two rural northwestern states.

Instrument

The Technology Integration in Teacher Education Instrument was developed by the researcher to collect information from teacher educators. The ISTE Recommended Foundations in Technology for all Teachers (Thomas et al., 1997) were used as a basis for development of the survey items. Additional questions were included to obtain demographic information and information about knowledge of technology standards. The report, *Teachers and Technology: Making the Connection* (U.S. Congress, 1995) was used to develop the support questions. The items were arranged in categories for clarity and in an order designed to encourage non-users of technology to respond.

The scales used in the section of the survey on technology issues were based on an instrument developed by the Northwest Regional Educational Laboratory for the Successful Schools Program. The instrument was designed to measure current status and to identify areas of strength and need. It utilized two related scales. The first scale, current status, indicated how the respondent currently rated each statement. The second scale, importance, indicated how important the respondent personally considered the item to be. Both scales gathered Likert type data (Ley & Nelson, 1990).

The instrument used in this study, a mail survey, was created by the researcher, judged and modified by three experts and other consultants. A pilot study was conducted prior to the collection of data.

The Northwest Educational Technology Consortium formatted the survey instrument, cover letter, and stamped self-addressed return envelope which were distributed to the population of full-time and part-time teacher educators at schools/colleges of education in two northwestern states between November 1, 1997 and January 4, 1998. Follow up correspondence to all non-respondents occurred in January and February 1998.

A total of 161 surveys were distributed by mail, eight of which were sent to people not included in the population. Seventy-two teacher educators responded. The response rate was 47.1%. Follow-up procedures were completed with a random sample of ten non-respondents.

Follow Up with Non-Respondents

Most researchers suggest that follow up measures be conducted if response rates are lower than 70% to 80% because of the likelihood that the lack of response could significantly alter the findings. A random sample of ten (12%) of the nonresponding group (n=83) was contacted by telephone interview. During the interview, a random sample of seven categorical items and six demographic items from the questionnaire were asked.

The answers to each of the question were compared with the responding group to determine whether the responding group responses were biased.

Method of Analysis of Data

Quantitative data analysis was performed using SPSS (version 6.1.1). The quantitative data were analyzed using non-parametric statistics. The Wilcoxon Matched-Pairs Signed-Ranks Test, a non-parametric test of two related samples was used.

Results

Description of Population

Most of the teacher educators in this study (over 70%) had used computers for more than ten years. The majority worked full time and held the rank of associate professor or professor. Forty percent had taught at the university level for more than ten years. In addition almost all had some teaching experience at the K-12 level. While their major teaching responsibilities were varied, the majority indicated they taught a combination of types of courses. This may indicate they are less able to incorporate technology into their teaching because of the need for differing strategies. The length of time they have been at the university may indicate that they are not aware of how technology is being used in the schools (U.S. Congress, 1995).

Areas of Strength

Areas of strength were found in use of technology to support personal productivity. Some of the more common applications of technology, word processing, communication, and on-line resources, were identified as significant areas of strength.

Personal use of technology included a wide variety of technology skills and concepts. When the high current status of use of word processing is taken into consideration, this could mean that teacher educators used and expected their students to use word processing for personal productivity and had lesser expectations in other areas. When people adopt a new technology, they tend to use it in the manner they used the technology they were replacing. Wetzel (1996-97) indicated that personal use of technology did not transfer to integration of technology into the classroom.

The other area of strength, access to a computer with Internet access, was identified as one of the highest overall on the current status scale. Earlier studies identified availability of computers with Internet access at work as an area of need (Willis, Austin, & Willis, 1994). However, the growth of the Internet and increasing ease of access seems to have helped to alleviate this deficiency as indicated by this study. Schools also seem to be moving in the direction of supporting this area.

Areas of Greatest Strength

Inventory item	n	IMP-CS
I have a computer with Internet access available at work for my use. (Q10)	72	-0.208 [a]
I expect my students to use word processing. (Q17)	72	-0.014 [a]
I use word processing for teaching and scholarship. (Q41)	72	-0.014 [a]
I use communication and on-line resources. (Q44)	71	0.084

[a] current status score greater than importance score, IMP=importance, CS=current status.
IMP-CS= mean of importance score minus mean of current status score for item,

Table 1: presents the greatest areas of strength as calculated by the difference of means for importance and current status. Four items were determined to be areas of strength. Three of the four had higher current status scores than importance scores.

Areas of Need

Areas of need have been divided into the following categories: support from university, integration into teaching, societal impact of technology, and use of standards. Areas of need tended to revolve around issues that support integration of technology into the classroom rather than use for personal productivity. Sixty percent, 27 of 45 items on the inventory were identified as significant areas of need. This indicates teacher educators and their students need to learn more before they can be considered technologically literate.

Support from university

Three of the seven items of greatest need dealt with support from the university. Teacher educators identified support from the university in areas of training, time, access to adequate hardware and software as one of their greatest needs for incorporation of technology into the program. To a lesser degree, they identified on-site technology support and a vision for how to use multimedia technology as significant areas of need. This finding agrees with earlier studies which rank support as a key component of integration of technology into the curriculum (Willis et al., 1995).

Integration into teaching

Expectations for students to use computers to support data collection, information management, problem solving, decision making, and access to information were also identified as areas of need. Computers and technology support student-centered learning. They have the greatest impact on student achievement when integrated into the curriculum and used as a tool to support learning. Computers and technology allow students to explore and analyze information (Caffarella, 1998).

Operation of multimedia computers and related peripheral devices, including imaging devices, and use of computers to create multimedia presentations are becoming common in schools. These were identified as areas of need for expectations of students. Many of the same skills and knowledge that were identified as areas of needs in expectations of students were identified as areas of need for teacher educators. Faculty may not have an awareness of the prevalence of these devices in the schools and their use.

Teacher educators need to become more proficient with use of multimedia computers and peripheral devices, including the use of imaging devices. They also identified a need to learn to install software and hardware and perform basic trouble shooting techniques. Even though most of the people surveyed had used computers for over ten years, they still did not feel confident in these areas. Willis et al. (1994) identified these as areas of need.

Distance education is becoming more common as access to and use of the Internet increases. Awareness of issues relating to distance education and its effect on education is another subject that is not often considered in schools of education.

Societal impact of technology

Another identified area of need was the importance of teacher educators to understand social, legal, and human issues. To a lesser degree, expectations of students to be aware of how computers and technology are used in society, was also identified as an area of need. The affect of technology on society and of society on technology is a topic found in science, social studies, and technology student standards (Caffarella, 1998). Since technology has changed society, it is important for teachers to understand these issues.

An existing need was identified for the items of personal awareness and expectations for students to demonstrate awareness of resources for adaptive assistive devices for students with special need. Both of these

items are often overlooked when considering technology. One of technology's greatest contributions has been in this area. With the emphasis on inclusion, teachers must have a greater awareness of technologies that will help all their students.

Expectations for students to have knowledge of equity, ethics, legal, and human issues concerning the use of computers and applications of distance learning were also identified as an area of need.

Use of standards

In the area of standards, teacher educators rated their current status of knowledge of standards rather high. The only significant area of need in this category was use of state and national standards in teaching. Evidence suggests (Wetzel, 1996-97) that when teachers use standards, student achievement increases.

Areas of Greatest Need

Inventory item	n	Z	p
I expect my students to demonstrate awareness of resources for adaptive assistive devices for student with special needs. (Q28)	72	-5.5109	.0000
My college/university provides the training I need so I can comfortably use computers and technology for teaching and scholarship. (Q14)	72	-5.4128	.0000
I am aware of resources for adaptive assistive devices for student with special needs. (Q37)	71	-5.2140	.0000
My college/university provides me enough time to use computers and technology for teaching and scholarship. (Q13)	72	-5.0438	.0000
I expect my students to observe demonstrations or uses of broadcast instruction, audio/video conferencing, and other distant learning applications. (Q30)	72	-4.7614	.0000
I am able to incorporate technology in my classes because my college/university provides access to adequate hardware and software. (Q15)	72	-4.5514	.0000
I expect my students to demonstrate knowledge of equity, ethics, legal, and human issues concerning use of computers and technology. (Q29)	72	-4.3708	.0000

Table 2: presents the seven items which were determined to be the greatest areas of need by their Z scores on the Wilcoxon Matched-Pairs Signed-Ranks Test. Three items deal with need for support from the university, three deal with expectations of students, and one deals with personal use of computers.

Conclusions

The use of self reported data and non-parametric statistics both limited the power of the study. Further limitations arose from the low response rate and the conflicting results of the non-respondent follow-up. Since the non-respondent sample seemed to have less experience with technology, their responses were probably due to lack of knowledge of the subject. Even with these limitations, it is still possible to use the findings to describe technology use in the teacher education programs.

(1) Teacher educators are proficient at using word processors and on-line communication. More emphasis is needed on the use of information management and problem solving applications, including spreadsheets, databases, and graphics.

(2) Teacher educators need much more support from their university to successfully shift from use of computers for personal productivity to integration of technology into their instruction.

(3) Teacher educators need opportunities to learn how to use multimedia computer applications to support student-centered learning including higher order thinking skills before they will be able to successfully integrate technology into their teaching.

(4) Teacher education programs should place a greater emphasis on the impact of technology on society and its implications for education.

(5) To help teacher educators obtain a vision of how technology can be successfully integrated into instruction, models need to be developed, tested for effectiveness, and disseminated. More research is needed on types of technology use and methods of integration into instruction.
(6) For standards to have an impact, they must be incorporated into teaching.
(7) For technology to be integrated into teacher preparation programs, it must be a systemic effort, which includes collaboration by all parties: administrators, faculty, support personnel, and students.
(8) Research is needed to investigate student perceptions of use of technology and integration of technology standards into teacher preparation programs.

Perhaps one of the greatest benefits of this study was to expose teacher educators to the ISTE Foundation Standards and to provide a vision for areas of technology that had not been considered before.

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More information about the original study may be found at http://www.alaska.net/~mccoy/index2.htm.

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Web-Based Electronic Teaching Portfolios for Preservice Teachers

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Abstract: This paper describes a qualitative research study concerning the use of the World Wide Web (WWW) to create Electronic Teaching Portfolios in a preservice teacher education pilot course. The goal of the pilot course was to learn about the participants' purpose in creating an Electronic Teaching Portfolio, the process they employed to create one, and the learning gained in the process. Interviews with the participating preservice teacher education students, participant observation in their class, and analysis of the journals students maintained revealed that the process was constructivist, demanding, and multifaceted. A brief review of the literature will be provided as well as a discussion of the empirical assertions that resulted from the study.

"The use of teaching portfolios in evaluating teacher performance is expanding, having been given particular attention by the National Board for Professional Teaching Standards, which requires teachers seeking national certification to submit portfolios to assessors for examination." (Cooper, 1997)

ÊIntroduction

One challenge in teacher education is how to measure preservice teachers' professional knowledge base and competence to teach. Multiple choice tests, which are easy to administer, grade, and use, are inadequate measures of the myriad of skills and knowledge that teachers should be able to demonstrate and use for instruction. These paper and pencil tests are incapable of measuring the performance-based Interstate New Teacher Assessment and Support Consortium's (INTASC) . Furthermore, the (NBPTS) recognizes the need for performance-based measures by requiring practicing teachers to submit portfolios in order to gain National Board Certification.

In response to such challenges, many schools of education are beginning to incorporate the use of portfolios as performance-based measures. McKinney (1998) explains that "[teacher] educators have found that well-constructed portfolios may help to capture the complexities of learning, teaching, and learning to teach when used as authentic assessment tools within courses and programs in Colleges of Education (p. 85). Also, portfolios can be considered performance-based because they "[allow] the learner to display a variety of evidence of performance, such as products or exhibitions"(Georgi & Crowe, 1998, p. 74). Another characteristic of portfolios is that they encourage preservice teacher education students to be more reflective about what they have learned through their university courses and student teaching. In addition, portfolios serve to document preservice teachers' competence and growth during the course of their entire teacher education program. Yet, most portfolios that are being used in schools of education today are primarily print-based (compiled in a binder), although they often contain teaching videos as one of the components. Now, with current technologies, it is possible to create Web-based, or Electronic Teaching Portfolios. Should schools of education invest the effort and time in teaching preservice teacher education students to create such portfolios? How can technology, specifically, the World Wide Web (WWW) facilitate the creation and utilization of Electronic Teaching Portfolios?

This paper describes a qualitative research study about use of the WWW to create Electronic Teaching Portfolios in a preservice teacher pilot education course. The goal of the pilot course was to discover the participants' purpose in creating an Electronic Teaching Portfolio, the process they employed to create one, and the learning gained in the process. A brief review of the literature will be provided as well as the series of empirical assertions formulated through the process of analytic induction (Erickson, 1986).

Electronic Teaching Portfolios

An Electronic Teaching Portfolio, sometimes referred to as a digital portfolio, is similar to a traditional portfolio, however, the medium used to present and organize it is different: It is organized using a combination of electronic media such as audio recordings, hypermedia programs, database, spreadsheet, video, and wordprocessing software, as well as CD-ROMs and the World Wide Web. In other words, "[the] electronically enhanced portfolio augments the traditional print portfolio with electronic materials that can strengthen particular portfolio components" (Lieberman & Rueter, 1997, p. 46). How it is published depends on the resources available in addition to the teacher's objectives. The items in the Electronic Teaching Portfolio will depend on its purpose (e.g., is it to fulfill the requirements of a course or teaching license), the instructors' and the students' technology experience, the resources available, and the amount of time (e.g., stand alone semester methods course or several years).

Tuttle (1997) contends that electronic portfolios should be used because they demonstrate wider dimensions of learning, their parts can be interconnected, and they save space. Lieberman and Rueter (1997) also contend that there are many advantages to using electronic portfolios, which they refer to as an "electronically augmented portfolio". Some of the advantages they discuss are:

- More types of information about the individual and his/her teaching can be included and displayed;
- Materials presented can be animations, simulations, and video clips;
- Electronic publications on the Internet...can be easily accessed;
- Portfolio materials are not lost during transport between reviewers (p. 4748).

Other advantages to using Electronic Portfolios by elementary school students, described by Bushweller (1995), were the use of audio and video recordings to document students' reading skills and the "effect in parent conferences" (in Georgi & Crowe, 1998, p. 80) of parents hearing audio clips of their children reading.

Although there are many advantages to using Electronic Teaching Portfolios, there are numerous disadvantages, too. Some of the disadvantages Lieberman and Rueter (1998) raise are:

- There may be too much emphasis on the 'bells and whistles' of the portfolio rather than on using technology to support the portfolio and meet the objectives of the designer;
- Potentially the readers of the portfolio may need to be provided with appropriate hardware and software in order to access information on a disk or on Internet provided by the portfolio designer;
- Portfolio readers and/or reviewers need to be educated about the importance of reviewing diverse portfolio components, e.g., electronic media.
- It may be inconvenient for the readers/interviewers to access the electronic information presented (p. 48-49).

Other disadvantages, discussed by McKinney (1998), are the amount of time needed to complete the portfolio, memory limitations, lack of access to the software and hardware to create the portfolios at home, and difficulties in mastering the technology itself.

While the use of Electronic Teaching Portfolios is growing, only a few studies have examined them in teacher education. Much of the research on Electronic Portfolios deals with K-12 portfolios. However, teacher educators are beginning to see how technology can be used to facilitate the process. Gamon and Robinson (1996) describe the use of CD-ROM portfolios at Eastern Washington University (EWU). At EWU, students complete their portfolios prior to graduating from the teacher education program (in Backer, 1997). These portfolios contain the students' accomplishments, teaching experiences, and evaluations.

Read and Cafolla (1997) also discuss what they have learned from the introduction of Electronic Teaching Portfolios instruction at Florida Atlantic University:

"Developing and implementing multimedia preservice teacher portfolios is an enormous responsibility and task. It requires the cooperation of students, faculty, staff, and administrators. The team in charge of the project must continually revise procedures, be aware of problems, seek solutions to problems, and keep students, staff, and faculty motivated as they move into the future."

Read and Cafolla assert that it is a complex process that involves more than just the students and an instructor.

McKinney (1998) conducted a study of five preservice teachers who constructed electronic teaching portfolios using the multimedia program HyperStudio. The students who volunteered to participate in the study were "confident in their use of technology...[and] saw the potential of the technology for themselves and for use in their future classrooms" (p. 100-101). McKinney found that the process of creating Electronic Teaching Portfolios was very positive, resulting in much reflection. In addition, she discovered that the students invested a great deal of time in creating their portfolios and encountered some problems with storing the portfolios and the software utilized to create them. She also suggested that further research should be conducted related to "how portfolios are used,...how to structure their development and how to support their use " (p. 101).

Research Methodology and Methods

Paradigm and Conceptual Framework

The paradigm for this study is interpretive inquiry. The main methodological assumption of interpretive inquiry is the focus on social interaction and the interplay between such interaction and the wider social context in which it occurs. Erickson (1986) explains that social interaction should be examined from the actors' points of view in a "wider social world" (p. 120); each of these points of view can have a different, even conflicting perspective. In such inquiry, the objective is to answer (or to discover and analyze) "What is happening?" (p. 121, 124). The conceptual framework for this study was constructivist theory; the roots of constructivist theory arise from the works of Vygotsky and Piaget, in addition to several other theorists. The conceptual framework defines the role of the researcher, forecasts the design for data collection, and grounds the study in a larger context. While there are different views of constructivism, such as cognitive and sociocultural constructivism, Duffy and Cunningham (1996) contend that constructivists of all stripes generally perceive "(1) learning [as] an active process of constructing rather than acquiring knowledge, and (2) instruction [as] a process of supporting that construction rather than communicating knowledge" (p. 171). In addition, they assert that constructivists "view the learning as the activity in context" where "[the] situation as a whole must be examined and understood in order to understand learning" (p. 171.)

Course Description

EDLF 589-04, *Electronic Teaching Portfolios*, was an elective, one credit, preservice teacher education pilot course, offered in Spring, 1998, at the University of Virginia's Curry School of Education. The Curry School offers a five-year teacher education program, in which students earn a bachelor's degree in an academic major as well as a Masters in Teaching. The goal of the pilot course was to learn about the process of using the WWW in the creation of Electronic Teaching Portfolios. The objectives of the course were for students to create Electronic Teaching Portfolios, to reflect upon their coursework and teaching experiences, and to become more proficient in the use of technology.

The course met once a week for an hour, followed by an hour of open lab time in which the instructors would be available to help students individually. The class was taught in a multimedia laboratory comprised primarily of PowerMac Macintosh computers. The software program utilized to create the portfolios was Claris HomePage; this program was chosen primarily because of its availability in the laboratories in the School of Education. The students had access to their own computer as well as digital cameras, scanners, and the Internet. The course syllabus is available at .

Participants

The course was advertised via e-mail to all of the fourth-years, fifth-years, and Masters students in early January of 1998. Eleven students enrolled in the course. One decided to drop the course because she had accepted a position to teach in a foreign country; another student decided to audit the course because she was having doubts about entering the teaching profession but wanted to continue to learn how to create Web sites. Of the nine remaining students, six were graduating, two were in their first year of the Masters of Teaching program (they had already earned bachelor's degrees at other institutions), and one was in her fourth year. Three students wanted to teach secondary English, one wanted to teach secondary History, and the rest of the students wanted to teach at the elementary level. The only students who had completed student teaching assignments were those who were graduating. In addition, of the nine students receiving a grade, six had never created a Web page. Therefore, instruction had to be geared to meet their needs.

Data Collection and Analysis

A number of strategies were used for collecting data. The two primary methods were interviews and participant observation. Seven of the students participated in one interview at the end of the course with the researcher. Interviews, lasting between thirty and sixty minutes, were taped and transcribed. The researcher also was one of the instructors of the course. She participated in all but one of the class meetings--most of which lasted two

hours. The researcher kept a journal of the course, which included observations, student comments, and anecdotal notes about student comments, progress, and questions. Other forms of data included: students' journals, their portfolios, and an informal questionnaire using a Likert scale that was developed by the researcher.

Erickson's (1986) approach to data analysis, analytic induction, was utilized for this study. His approach is holistic and considers the researcher's assumptions as well as the participants'. At the heart of Erickson's approach to data analysis, is the formulation of empirical assertions--conclusions or statements about the data made through analytic induction. These assertions in turn must be confirmed or disconfirmed by a search for empirical warrants. Warrants can be exemplified by direct quotes from documents, fieldnotes, interviews, or observations that have not been combined to form a portrait of the situation being studied. According to Erickson (1986), "this is done by reviewing the data corpus repeatedly to test the validity of the assertions that were generated" (p. 146).

Results of the Study

Students reported, in taped interviews at the end of the course and in the journals they maintained the entire semester, that the process of creating Electronic Teaching Portfolios was very positive, resulting in reflection about themselves and about the teaching profession. However, it also was very frustrating at times and time consuming for the students. One of the main frustrations was learning to use the technology. The goal of the pilot course was to learn the participants' purpose in creating an Electronic Teaching Portfolio, how they created it (the process), what they learned as a result of creating their portfolios, and the advantages and disadvantages in using the WWW to create these portfolios. The following empirical assertions were warranted through the process of analytic induction:

Assertion 1: Creating Electronic Teaching Portfolios is a constructivist process that promotes an examination of students' beliefs, philosophies, objectives, and purposes for teaching.

The process of creating the Electronic Teaching Portfolios was a challenging, constructivist process that required students not only to master the technology skills but also to critically evaluate their beliefs, philosophies, objectives, and purposes for teaching. Choosing what to put into their portfolios was difficult for those who had amassed boxes full of activities, papers, and unit lesson plans, and for those who had not yet experienced student teaching (the fourth years and Masters of Teaching students in their first year of the program). Students often asked: "What should I include in the portfolio? A whole unit, one lesson, a variety of lessons?" Several discussions ensued as a result of such questions with students taking different positions about what or how much to include. Some students argued that the portfolio should be as concise and simple as possible, considering most viewers (such as principals) do not have the time to spend reviewing the portfolios; others maintained that it should be rich and visually pleasing, with many artifacts supporting one's competence. In the end, students determined on their own what was most acceptable to them. Curiously, no two portfolios were alike.

Besides deciding what to include, students had to determine how to organize and present their work on the WWW. The process for most students involved working collaboratively with other students in the course, learning how to use the technology, and exploring ways to organize and present the portfolios. The process was constructivist in that students were actively involved in creating and piecing together their portfolios. "Central to the vision of constructivism is the notion of organism as 'active'--not just responding to stimuli, as in the behaviorist rubric, but engaging, grappling, and seeking to make sense of things" (Perkins, 1992, p.49). It was evident that students were engaged in such conduct. One student explained the process she undertook in creating her portfolio:

"Well, I guess it started with surfing the Web and seeing what current electronic portfolios look like. Then going to the [Teaching Resource Center] and looking at portfolios on paper and then making notes to myself about what I would want in my own, and coming up with a table of contents to organize it. And then basically, you know, just the whole, the whole process of copying your documents, choosing your backgrounds, choosing your clip art, so basically it was getting that background information and understanding it and then deciding which were my personal decisions about what should go in and how it should look. I mean, that really does develop over time. Also, I really liked looking at the work of other people in the class. [Student's name deleted] helped me figure out how to do, like, in the portfolio and [Student's name deleted] resume helped me figure out how to put student teaching in there. So I think it was really collaborative and that we all made good use of our resources. Definitely wasn't done in isolation and this class just made it much more collaborative than it would be otherwise." [Interview with First year Masters Student]

Students learned a great deal about themselves and their beliefs connected with teaching as a result of creating their Electronic Teaching Portfolios. As with other studies regarding portfolios in teacher education, the act of creating portfolios in this course fostered reflection. As one student explained:

"I think I've learned the importance of self-awareness. Of knowing what your goals are and knowing where you stand in philosophies. It helps you much more be critically aware and lets you be more observant when you're reading other texts or when you're reading other resources in your classes. And you say "hey, this is what I believe in." When you're fully aware of what you're thinking of, rather than just saying hey, sounds like a good idea, without knowing exactly where it stands with comparison to your policy." [Interview with graduating student]

Assertion 2: Constructing Electronic Teaching Portfolios using technology, specifically the WWW, was a complex and demanding process for students.

Using the WWW as the presentation medium was demanding not only in terms of learning the idiosyncrasies of the technology itself, but also in understanding the big picture. Understanding what the end product would look like took time for students to understand. The biggest hurdle, however, regarding the use of the WWW, especially for those who had not ever created a Web site, was learning the technology. Creating the Web sites did not always go smoothly, and many students became frustrated and angry, as a student described her experiences in learning to use the technology:

"Just getting over the hurdle of all this computer stuff... but all the little glitches, it's just something I had a good attitude and then I also had a bad attitude. But it's one of those things you just have to jump in and do it. And you don't like it while you're doing it, when you're struggling, but once you've succeeded you love it, it's the best thing ever. So, I guess just in general, just the little glitches when you thought you did it right and, you know, and it's not, the spacing's all off.... it's more just the, the whole home page kind of when you change to the computer language... that was the most confusing part that it would just assume, you know, it would take a picture and just assume it got it from the desktop and then it wouldn't show up. So just those little, little things that you, even in a book you don't understand until you do it, really do it." [Interview with Graduating Student]

While there were many examples of university professors' Electronic Teaching Portfolios on the Web, there was a dearth of portfolios by inservice or preservice teachers. Because of the lack of examples on the Web, students had to rely on the instructors and each other for suggestions on how to organize and present their portfolios. In addition, many of the students' activities and lessons had to be recreated or re-worked to put them on the Web; in some cases, students decided it was not worth the trouble to try to figure out how to include some of their work on the Web.

Assertion 3: Students enrolled in the course to enhance their technology skills, to create a portfolio in a structured manner, and to make themselves more marketable for jobs.

Students primarily took the course for three reasons: 1) to enhance their technology skills, 2) to create a portfolio in a structured manner, and 3) to make themselves more marketable for jobs. All of the students in the course except for one--who considered himself competent in using technology--mentioned taking the course to gain or improve technology skills. Students viewed the creation of a teaching portfolio as valuable not only in their endeavors to find a job, but also as a way to demonstrate what they had learned so far. The students indicated that while they believed it was important to create a portfolio, they also recognized they wanted guidance to create their portfolios, which the course could offer. Surprisingly, even the students who were not graduating wanted to create portfolios to make themselves more marketable for future job interviews, or at the very least to demonstrate to others in a meaningful way their experience at the Curry School. In addition, the students viewed the technology skills they learned in the course to be beneficial both personally and professionally; indeed, several of them perceived that knowing these skills would help them with their own students in the future. As one student explained:

"Well, actually in December when I went home after student teaching I really wanted to start getting a portfolio together. And then over, the break just went really quickly and I never really, I just had stacks of stuff I wanted to include and I knew I had to go back and change some things. When I came back I saw your E-mail and I wanted to, I thought I wanted some guidance on how to do it correctly. Cause no one had really said, there's no class that tells you how to do it. And also technology, and I wanted to take the opportunity to, my last year, to make sure I was equipped with it. And right now I have a contract with [county name omitted] County and in with [county name omitted] County you have to make a Web site with your kids." [Interview with graduating student]

Conclusion

Electronic Teaching Portfolios created using the WWW combine the benefits of a standard teaching portfolio with the advantages and challenges of learning to master the use of technology to present them. As schools of education and NCATE explore the possibilities of using technology to organize and present portfolios, they also should keep in mind the disadvantages to using technology and privacy issues. Creating Electronic Teaching Portfolios can be both frustrating and rewarding. An added benefit to using Electronic Teaching Portfolios is that they also can demonstrate students' competence in the use of technology. Finally, more research should be conducted to determine whether the cost and time outweigh the resultant reflection and technology skills that students learn in the process of creating Electronic Teaching Portfolios. Just as McKinney (1998) suggested, more research needs to be conducted regarding portfolios, especially with respect to Electronic Teaching Portfolios.

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Teaching Introductory Educational Technology to Preservice Teachers: Using a Content Area Specialization Approach

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Abstract: This paper describes the University of Virginia, Curry School of Education's approach in providing content-specific educational technology classes for preservice teacher education students. EDLF 345, *Introduction to Educational Technology*, has been designed to provide preservice teacher education students with foundational knowledge and skill in using a variety of technologies that utilize content-specific applications of technology in their respective disciplines. As *Introduction to Educational Technology* has evolved over the years, we have learned that placing preservice teachers with similar goals in the same class offers students with a clearer understanding of how to integrate technology into their content curricula. A brief review of literature will be providedas well as a discussion of some of the benefits and challenges in designing and teaching an introductory technology course using a content-specific approach.

Introduction

Genuinely integrating technology into preservice teacher education programs requires system-wide change, initiative, and time. The University of Virginia's Curry School of Education, recognized for its leadership in integrating technology, understands many of the factors needed to effect change of this kind. Currently, the Curry School participates in a number of endeavors to more effectively infuse technology into its instructional program. One of its efforts was the establishment of the (CTTE) in 1997; a goal of the CTTE is to prepare preservice teacher education students to be educational technology leaders. To cultivate these leaders, the CTTE promotes the integration of technology into methods courses and requires all of its preservice teacher education students to complete an introductory technology course, , *Introduction to Educational Technology*. Unlike most stand-alone technology courses, EDLF 345 incorporates content-specific instruction in utilizing technology. Grouping students into three different areas of emphasis--elementary, secondary Humanities, and secondary Math/Science--allows instructors to design classes that move beyond mastery of basic technology skills to instruction that encourages students to think how technology can be used in instructional practice. This paper discusses a rationale for employing such a model and some of the benefits and challenges experienced by the instructors who designed and utilized the content-specific approach.

Rationale

Perceptions of educational technology have evolved over the years, as is evident in Willis and Mehlinger's (1996) description of the growth and change of educational computing courses during the last two decades. One reason for the transformation is the variable definitions of educational technology. For instance, in the 1980's educational computing was seen as a subset of computer science. In contrast, the 1990's standpoint views educational computing as a specialty with connections to educational fields such as curriculum and instruction, educational psychology, instructional design, and instructional technology (Willis & Mehlinger, 1996). Kiefer's (1991) work further explains the importance of the shift; his work suggests that the 1990s may see an increase in subject- and level-specific content, with the integration of technology into methods courses becoming more critical (in Willis & Mehlinger, 1996).

Kiefer's predictions of the 1990s, however, have yet to be fully realized. Nonetheless, growing numbers of teacher education faculty around the country are sharing the same vision. Recently there has been an emerging national consensus that technology instruction for teachers should be specific to the discipline taught by the teacher.

This may be a response to the Congressional Office of Technology Assessment's (OTA) (1995) findings that the majority of "technology instruction in colleges of education is teaching *about* technology as a separate subject, not teaching *with* technology across the curriculum" (p. 165). The consequences for teaching the "tools" versus teaching the application of the tools results in a limited knowledge about how to integrate technology instructionally.

Most teacher educators agree that stand-alone technology courses are of limited value if isolated from the remainder of the teacher education curriculum (Willis & Mehlinger, 1996). The challenge exists in how to accomplish an objective that involves a commitment from faculty, resources, and *time*. Cooper and Bull (1997) contend that teacher educators supporting these changes need to consider that change rarely occurs overnight: "it is important to be realistic about the time frame that will be required to accomplish this [integration throughout the curriculum] in the depth that may be eventually desired" (p. 101). As a result, EDLF 345, *Introduction to Educational Technology*, undergoes restructuring each year as the course description below illustrates.

Course Participants

The Curry School offers a five-year teacher education program, in which students earn a bachelor's degree in an academic major as well as a Masters in Teaching. The majority of the 105 students enrolled in are in their third year at the University. Ten have earned bachelor's degrees prior to taking the course (they are working on their Masters in Teaching) and one is in her fourth year of the five-year program. While students possess a firm understanding of their content areas, many lack knowledge of educational methodology because students begin taking these courses in the second semester of the third year. Hence, students enroll in EDLF 345 with limited methodological knowledge regarding instructional strategies for teaching. In addition, there is a wide range of technology ability amongst students, ranging from the beginning to the intermediate levels and above. Students who exhibit intermediate-to-advanced skills at the beginning of the semester are recommended to enroll in , *Instructional Computing*, which has a student-teaching component.

It is important to note that EDLF 345 is not the first experience most students encounter using technology at the Curry School. All second-year students are required to enroll in a field experience course (Masters students are not required to take this course). As part of the course, students develop basic, prerequisite technology skills during three class meetings (for a total of approximately five hours of technology instruction) on such topics as intermediate word processing, email, newsgroups, and the World Wide Web. These "basic" technology experiences provide a continuum to build upon in EDLF 345. Since students enter EDLF 345 with these "basic" skills, instructors in 345 are able to concentrate on more content-specific issues. And, with each year, instructors encounter students with a wider range of technological abilities. The field experience course offers the less-skilled students a leveling ground, carrying them to a plane comparative to the more adept students.

Course Description

A primary objective of EDLF 345 is to ensure that all teacher education students have a foundational level of technology expertise. An additional goal, part of the restructuring of the class in 1998, includes presenting technology instruction using a model that prepares future teachers to employ these tools in a content-specific context. Just two years ago a former instructor described that it was difficult to implement technology training using an integrative model (Kovalchick, 1997). At the time (1996-1997 school year), the course was taught in a generic manner, with students from all content areas placed together in the same classes. Technology instruction involved teaching a standard, basic mastery of educational technology with an emphasis on how to use the tools as opposed to how to teach with the tools and apply them for instructional purposes. For the 1997-1998 academic year, attempts were made to make instruction more content-specific; however, because students were not grouped by area of emphasis, this was difficult to accomplish. It was challenging for the instructors to provide examples that were content-specific to elementary and secondary level students enrolled in the same course.

This year, a major shift in the course arose out of the CTTE's and teacher education faculty's desire to improve the course to make it more meaningful for students by offering content-specific instruction. Moreover, faculty expressed the need for students to enter their courses with knowledge in *applying* technology in the students' content areas. In the previous year, it was clear that such attempts were not too successful considering the grouping of students for the course. As a result, the CTTE and the director of teacher education decided to divide EDLF 345 into three separate areas of emphasis to facilitate integration of technology tools directly into content-specific

curriculum. The three different areas of emphasis are: Elementary (two sections), Secondary Humanities (one section), and Secondary Math & Science (one section). Although each section learns similar software, instruction and examples aim at the section's particular content area. Consequently, unlike in previous years, students experience ways to develop an understanding of how to apply these technology tools into their content areas.

EDLF 345, *Introduction to Educational Technology* is a two-credit, performance-based course. The course introduces a variety of software throughout the semester. The class begins with instruction on paint/draw programs, then progress onto more difficult applications including PowerPoint, Hyperstudio, Web site creation, on-line databases, and mind-productivity tools (databases and spreadsheets). Each week, students complete a , an activity designed to give students a minimal level of hands-on experience and practice integrating each topic reviewed into their content area. Competencies consist of a basic assignment graded on a satisfactory/unsatisfactory basis--provided the competency meets all of the criteria stipulated. Unsatisfactory competencies can be resubmitted for full points, allowing students to properly master each week's topic if they experience difficulty. Competencies include creating a newsletter using a word processing program, presenting a lesson using PowerPoint®, creating Web pages, making spreadsheets, etc. Competencies usually address a (VSOL) as well as national curriculum standards specific to the student's content area. Students also maintain an (e-journal) that reflects upon their developing beliefs and experience using technology over the course of the semester. Furthermore, students participate in one of two field assignment activities: They assist the facilitator of a community computer class or participate in a computer teacher simulation. Finally, the capstone project for the course is the development of a "showcase" (Halaydna, 1997; Shackelford 1997) comprised of samples of their work including a self-evaluation of the quality of the work, an explanation of why the work is included in their portfolio, and how – as a teacher – they might use the technology represented toward their instructional goals (Kovalchick, 1997).

Teaching Methodology

EDLF 345 presents a variety of topics during the semester concentrating on skills and applications that progress in complexity. The sequence of instruction allows students to build upon the previous week's experience. The development of skill acquisition begins with basic knowledge about how to manipulate paint/draw tools—essential fundamentals for many graphics programs. The course then proceeds to the creation of newsletters, incorporating the insertion of clip art and graphics from the web, and using paint/draw simultaneously in word processing documents. These skills form the foundational skills for creating a content-specific lesson using PowerPoint based on a VSOL; they present their slides with an accompanying lesson outline to the class the following week. Thereafter, students tackle (in sequence) HyperStudio, the creation of two web sites, databases, and spreadsheets. As a culminating cooperative project, students create a in groups of three or four.

There are several advantages to having students with similar content interests in the same class. One is the opportunity for discussions about how the technological skills being learned can be integrated into content curricula. These discussions are more fruitful in the content-specific courses offered this year than in the mixed classes of previous years because students can debate how to best use these tools with a tenth grade science high school class or with first graders. Another advantage is the sharing of ideas and lesson outlines between students that they create individually or cooperatively. For instance, a student in the elementary section wrote in her e-journal: "Today's presentations were incredible. Seeing what other students came up with gave me great ideas for the classroom." Another student from the science section wrote, "I really got a sense of the large number of ways that PowerPoint could be effective." The majority of other students' responses were similar. On most occasions students shared many innovative and creative ways of integrating technology into their content area. Clearly, the opportunity to share ideas with peers is enhanced by providing content specific sections of EDLF 345.

Challenges

For the instructors, perhaps one of the greatest challenges in breaking the course into three different areas of emphasis is the fact that instructors are not content experts in every area. While the CTTE actively recruits instructors with diverse backgrounds, it is difficult (and nearly impossible) to obtain instructors with a range of elementary and high school experience in the humanities, mathematics, and sciences. For instance, the instructors for the 1998-1999 school year have complementary credentials, with expertise in elementary and high school and

college-level mathematics education. Even so, it is difficult at times to provide sound examples to each content area and for every class.

Another challenge is adapting to students registered in sections that are different from their content areas. An example is a student who wishes to be an English High School teacher enrolled in a Math/Science section. Most glaring is the placement of Foreign Language students in the Math/Science section, as well as the dilemma of where to place Physical Education students. These mismatches are primarily due to scheduling conflicts. For the instructors, the option is to either make an effort to provide multiple examples or to require students to learn from an example not aimed in their content area. Usually a combination of both options is utilized.

A final challenge has been in creating a course schedule suitable to meet the needs that exist within each content area. Selecting software and creating assignments appropriate for each section prove to be difficult tasks. For example, while secondary mathematics students find value in spreadsheets, secondary English students are doubtful as to whether they can effectively incorporate them into a lesson addressing a Standard of Learning. However, spreadsheets are required skills by most technology standards for teachers.

Conclusion

EDLF 345, *Introduction to Educational Technology*, evolves and changes from year to year. By adapting to new technologies, more adept students, and the higher expectations placed upon the course by its instructors and the Curry School, the course moves closer to its goal of adequately preparing preservice teachers to integrate technology into their methods courses. Restructuring the course each year is not an easy process; however, the most recent change of offering content-specific sections has proven to be very successful. It is exciting to watch students thinking of ways to implement technology tools with instructional objectives. As students enter their methods courses, they will find themselves capable of performing a variety of tasks using technology.

With this year's offering of EDLF 345 nearly completed, ideas for improving next year's classes are being shared. Several goals have already been set towards this end; they are: increasing communication with teacher education methods faculty, adding a fifth section to lower class sizes, and providing a different schedule and set of competencies for each content area section. The latter goal will be exceptionally difficult and time consuming to implement, but through the collaboration of students and methods faculty, EDLF 345 will changing to better prepare its students to be the educational technology leaders of the 21st Century.

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The Effect of a Shared, Intranet Science Learning Environment on Academic Behaviors

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Abstract: As technology continues to make its way into daily classroom use throughout all disciplines and across all grade levels, the question of its impact and effectiveness is heard in rising crescendo. This study investigated the effects of a shared, Intranet science interactive learning environment on the academic behaviors of problem-solving and metacognitive reflection. Results indicate that learning behaviors within science web-based environments provide support for this learning environment model.

1. Introduction and Rationale

As the Intranet is introduced into the learning environment comprising the classroom today, the effects of this technology must be investigated. Technology offers opportunity to affect academic behaviors such as problem-solving ability and metacognitive reflection.

As technology creates a virtual classroom environment as it moves to a web-based space, research must be conducted to determine the effectiveness of geographically unrestricted, collaborative problem-solving (Jacobsen and Levin, 1993). This type of collaboration becomes possible when the learning environment is placed on a web of computers, thereby facilitating access by many to the same place on the Intranet.

As students use the collaborative capabilities of a networked Intranet learning environment, thinking about their own thinking evolves, thereby increasing the opportunity to clarify misconceptions of knowledge, procedural or declarative. The science classroom presents one opportunity to study the effects of a shared, Intranet environment on student problem-solving ability and metacognitive reflection skills.

The purpose of this study was to investigate the effectiveness of a shared, Intranet learning environment on problem-solving ability and reflective metacognition on 9th-10th grade biology students. Should any gender differences emerge within this shared, Intranet environment arise, they were studied.

2. Research Questions

1. Will the use of a shared, Intranet environment improve learner problem-solving ability in science as measured by pre- and posttesting?
2. Will the use of a shared, Intranet environment increase learner metacognitive reflection as measured by use of pre- and posttest visual learning software (Inspiration) as measured by a) number of concepts used, 2) number of concept links used, and 3) number of concept nodes used to determine changes in learner thinking patterns, and by web-based Course Info software tracking capabilities within a threaded discussion site and?

3. Will gender differences emerge with the use of a shared, Intranet environment in the science area as determined from pre- and posttest scores measuring problem-solving ability and metacognitive reflection?

3. Methodology

Subjects: Subjects for this study were first time 9th and 10th grade biology students from three public education high schools in the Conroe ISD within Conroe, Texas. The sample (n) contained 78 students of the 1400 students enrolled in Biology I courses. Two classes from each school were selected and randomly assigned to a control class and a treatment class. Selected campuses operated on an A-B, 90-minute class alternating block schedule. Classes operating on this type of schedule met certain classes three (3) days per week and two (2) days per week alternating every other week. The sample population included male and female subjects.
Technology: Groups assigned to treatment groups received access to technology. This technology included MacIntosh platform computer labs or classroom computers. All treatment groups accessed minimally 6 computers and maximally 10.

Scanners, digital cameras, and Internet-connected computers, and laser printers rounded out the technology utilized by the treatment groups. Software access included Apple QuickTake PhotoNow software, HP scanning software, MS Office, Netscape Navigator Gold 3.0, and Inspiration 4.0.
Ecology Curriculum: To limit any physical risk each teacher at selected campuses will receive an Adopt-a-Ditch ecology curriculum (Stone and Myers, 1994). The researcher provided training for all curriculum lessons, use of the LaMotte Freshwater Testing Kits, web-based database, and administration of all pre and posttesting instruments. Intentional Intranet discussion forum topics were generated by teachers and the researcher during the training sessions. Spontaneously generated forum topics were noted as the researcher analyzes collected data within the web-based learning environment.
Teacher Training: Training occurred over a three day time period for 2 hours each day. An additional 1.5 hrs. of on-site training session ended the teacher training sessions. All training occurred prior to research initiation. Each teacher received complimentary computer diskettes upon completion of each training session.

Technology training consisted of instruction and practice in the use of the CourseInfo Intranet simulation software (Blackboard, Inc., 1998) Inspiration (Inspiration Software, Inc., 1994) uploading and downloading files via the Internet, digital camera use and downloading of images, use EXCEL spreadsheet/graphical capabilities, and use of the Discussion Forum environment.

All teacher training sessions involving the La Motte Freshwater Testing Kit focused on MSDS safety sheets, general safety practices, disposal of used testing solutions, disinfecting procedures following field work, understanding each freshwater test, and practicing testing techniques (LaMotte, Inc). All teachers received a pail of kitty litter for use during the study. This training insured the highest standard of safety would be established by each teacher in the study and maintained for all class sessions where necessitated by the curriculum content.

Training involving discussion and overview of the ecology curriculum document was incorporated into each training day. Both treatment and control version curriculum documents were used in this training.

Instruments: Treatment and Control groups were randomly assigned at each campus by the principal investigator. Both treatment and control groups on each campus were taught by the same teacher. Several instruments were used to discern problem-solving ability and metacognitive reflection both in the treatment and control groups of this study.

Problem-Solving Ability

The Watson-Glasser Critical Thinking Appraisal was used to measure student's problem-solving ability (Psychological Corp., 1990). The Watson-Glasser was selected due to its design to measure certain aspects of critical thinking including 1) the abilities to recognize problems, 2) evaluate evidence cited to support claims for truth, 3) reason inferentially, and 4) apply the preceding to problems. The test included norms for high students that were developed systematically for this grade level. Its reading level was ninth grade and the mental skills it demands were probably above that. The test could be administered in a group setting, and was timed at 40 minutes which "fit" the campus classroom schedule of the treatment and control groups. Validity of the test was more than acceptable when assessing instructional programs. Evidence supports several aspects of the construct validity of the Watson-Glasser instrument. This instrument was used for assessing problem-solving for both the treatment and control groups.

Metacognitive Reflection

Metacognitive reflection was measured through use of student-generated concept maps developed with the visual learning software program Inspiration (Inspiration Software, Inc., 1994). Concept maps were reduced by 1) the number of concept used, 2) the number of concept links used, and 3) the number of concept nodes used. As part of a secondary research question, an evaluative analysis of the CourseInfo software was undertaken. The tracking capabilities of the software CourseInfo were evaluated through measurement of 1) log-ons to the threaded discussions webpage, 2) number of threaded statements, 3) number of threaded dialogue statements of response to other student statements, and 4) number of threaded dialogue statements of response to teacher statements. Analysis of tracking user movement within the shared web-based environment gave some indication of problem-solving and metacognitive reflection abilities within the environment.

4. Findings

In answering the first question [Will the use of a shared, Intranet environment improve learner problem-solving ability in science?], group means indicated no support for problem-solving improvement. While groups did not differ significantly in terms of problem-solving ability, results from t-Test analysis suggested slight movement toward improvement as a result of exposure to the shared Intranet environment. Significant support for increases in problem-solving ability were seen when individual differences, as measured by paired analysis, were employed. When consideration was given to the individual nature of problem-solving ability, these findings indicated even clearer support for the use of collaborative, constructive, and connected technologies in the potential increasing problem-solving abilities. Use of these technologies within the framework of the science classroom because of the problem-based opportunities appears productive and naturalistic. By providing the contextualization for meaningful inquiry meaning-making thrives and re-application of that meaning to new, problematic situations increases. Problem-solving, or critical thinking, within the context of

web-based shared, learning environments strongly indicates additional research be undertaken to further address the learning behavior.

The scrutiny of length of exposure to this environment becomes an important one. Much research supports lengthy time periods of exposure to shared learning environments as methods connected to increased problem-solving ability (CSILE, 1989; Ryser, Beeler & McKenzie, 1995). Yet, exceptionally small numbers of studies have been undertaken to discern the effect of compacted time periods focused on increasing problem-solving abilities (Abeygunawardena, 1997). A limitation of this study would appear initially as the short timeframe allotted to the study. However, the timeframe utilized represents the reality of many science approaches currently in use. The findings of this study become more relevant given the design methodology mirroring classroom realities. The significant findings for paired differences should continue to be studied, but should also be taken as potential methods for increasing problem-solving ability. While this study does not address all possible questions of what increases problem-solving ability, it does examine one particular model, that of a shared, Intranet science learning environment. Through this examination results indicate the possibility this environment has as one method for potentially impacting problem-solving ability. As the length of time of the study is considered in concert with problem-solving ability, one continues to ask if something else was at work contributing to this increase in problem-solving ability over this short duration. This query leads to the discussion of research question two.

Data analysis of research question two [Will the use of a shared, Intranet environment increase learner metacognitive reflection as measured by use of pre- and posttest visual learning software as measured by a) number of concepts used, 2) number of concept links used, and 3) number of concept nodes?] indicated significant support for improved metacognitive reflection when measured by number of concepts, number of concept links, but not number of concept nodes used. Use of the visual learning tool accessing the concept maps within the shared, Intranet learning environment improved the amount of reflective thinking in which learners engaged at significant levels. Both group means and paired analyses supported changes in metacognitive reflection at significant levels.

The power of metacognitive reflection has been well-documented (Jonassen, 1996). The construction of individual representations allows learners to monitor and facilitate their own problem-solving (Gordon, 1996). The process of metacognitive reflection appears to become inextricably connected to problem-solving ability. Add to this process the multiplicative power afforded by a shared, Intranet learning environment and the element of time, as linked to improvement at individual levels of problem-solving, appear to become compacted. The results of this study robustly support the use of visual learning software (concept mapping tools) within a shared, Intranet learning environment to improve not only metacognitive reflection, and thusly problem-solving ability in a less direct way.

The robust results of improvement of metacognitive reflection within the shared, Intranet learning environment and the interwoven connection to problem-solving ability seem to suggest a model for the improvement of problem-solving ability within shorter timeframe constraints. Further research seems warranted, as well as worthwhile.

In addressing research question three [Will gender differences emerge with the use of a shared, Intranet environment in science for the academic behaviors of problem-solving ability and metacognitive reflection?] Analysis of gender differences in problem-solving ability and metacognitive reflection indicated no levels of significant differences. Group means and paired analyses for problem-solving ability and metacognitive reflection showed no differences with the

shared, technology-supported science setting. At first glance these findings shape themselves as contradictory to landmark gender studies (Bailey et.al., 1992). However, when the shared, Intranet environment is scrutinized, a cooperative and collaborative nature reveals itself. Environments of this type seem to appeal, and rank high, with the feminine gender(Miller, Chaika & Groppe, 1996). The lack of significant gender differences in problem-solving and metacognitive reflection resulting from the shared, Intranet learning environment strongly suggests an equalizing effect (Loyd and Gressard, 1989). This shared technology-supported learning environment may pose one model which science classrooms can use to create equal opportunity in scientific endeavor for both genders. At the very least the lack of any significant differences as a result of the environment presents potential for a model of improvement of problem-solving ability and metacognitive reflection which crosses all boundaries of gender.

5. Future Implications

The results of this study present one practical model for infusing technology into the classroom setting, for improving problem-solving ability and metacognitive reflection over a short duration, for creating a collaborative, cooperative learning space, and for maintaining a science space for learning where no gender differences arise.

The power an Intranet offers within the constraints of a school district, or geographic locale, have not yet been tapped. This study proposes one mechanism for doing just that given the infrastructure present or absent through the use of a web-based Intranet. This model offers a "get your feet wet" method of networked connectivity for classrooms and teachers who have not yet jumped into the world-wide web.

This research provides a study in contextualizing connectivity with end goals of improved problem-solving and metacognitive reflection. Both of these elements are often lost when initial attempts to jump into networked learning occur or are contemplated. Further, this study provides an avenue of documenting the nature of learning during the use of web browsing or other networked connections. Tracking learner movements within a browsed website has metacognitive as well as problem-solving implications for each and every learner.

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ELECTRONIC PORTFOLIOS IN TEACHER PREPARATION COURSES

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Developing portfolios electronically provides students with ways to demonstrate a broad range of abilities, as well as give them more awareness of the unique capabilities of technology in creating meaningful forms of alternative assessment. A well-designed electronic portfolio system can support this approach and offer expanded potential for collecting different kinds of records of students' work. Final products in a variety of media (text, graphics, video, multimedia) can be included using video and computer technologies. Teacher candidates from two small university credential programs created portfolios using either web page (HTML) or Hyperstudio templates customized to address specific course objectives. Electronic student portfolios stored on CD-ROM provide a practical demonstration of the use of multimedia technology as a means of preserving student work, presenting evidence of meeting course objectives, and providing a framework for student reflection.

INFUSING TECHNOLOGY INTO THE PRESERVICE TEACHER EDUCATION PROGRAM THROUGH ELECTRONIC PORTFOLIOS

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Abstract

Helping prospective teachers become aware of the uses of technology in education is an important goal of today's teacher preparation programs. Three education reform themes concerning the preparation of teachers for the 21st Century converge in this study: teacher accountability to professional certification standards, authentic assessment, and understanding of advanced technologies. The question of how to use technology effectively in the assessment of teacher candidates in order to demonstrate achievement of course objectives based on state certification standards led to the development of an electronic portfolio project in two small university teacher training programs. The potential for using technology in assessment is examined through analyses of electronic portfolios created by teacher candidates as well as interviews to gather information concerning experiences of collecting and preserving electronic evidence. The researchers' process of designing templates in hypertext markup language (HTML) and Hyperstudio, a multimedia authoring software program, provides further insight into the design and implementation of the electronic portfolio project

In 1997, the National Council for Accreditation of Teacher Education (NCATE) issued a report called "Technology and the New Professional Teacher: Preparing for the 21st Century Classroom." The NCATE Task Force on Technology and Teacher Education recommends that NCATE stimulate more effective uses of technology in teacher education programs. In order to prepare students to teach in tomorrow's classrooms, "they must experiment with effective applications of computer technology for teaching and learning in their own campus practice" (NCATE, 1997). The International Society for Technology in Education (ISTE), along with NCATE, established standards which challenge higher education to incorporate technology across the entire teacher education program, not just as a single computer literacy class added to the existing curriculum (1997, p.7).

According to the NCATE task force, teacher education has the responsibility to prepare students for teaching in the 21st Century, even though that future is impossible to predict with the rapid developments in technology. The task force states that teacher education is in a time of transition, calling for experimentation and a new attitude that is "fearless in the use of technology" (p.6). NCATE recommends that teacher education programs provide early experiences for their students and that technology be integrated into other education reform efforts (p. 8). Education reform documents focus on

the importance of rigorous standards for the certification of teacher candidates, authentic assessment aligned to these standards, and the use of technology as a potential tool for assessing these standards.

The U.S. Department of Education (1997) acknowledges the potential of technology for integrating assessment into the daily life of the classroom. The 1993 U.S. Education Reform Studies indicate that technology facilitates (1) obtaining a trace of student thinking processes, (2) collecting real-time feedback from multiple students, (3) storing and retrieving student work and associated comments, and (4) setting individual goals and managing instruction" (U.S. Department of Education, 1993). Bennett and Hawkins (1993) state that technology can make crucial contributions to the creation of workable and meaningful forms of alternative assessment and that computers and video records offer potential for collecting and storing records of students' work.

Lankes (1995) discusses the use of computer technology as a "likely solution" to the problem of creating, managing, and storing portfolios. Electronic or computer-based portfolios are similar to traditional paper portfolios, but information is collected, stored, and managed electronically with computerized text, graphics, sound, and video. Lankes (1995) states that computer-based portfolios provide authentic demonstrations of accomplishments and motivate students to take responsibility for their own work. Sheingold and Frederiksen (1994) indicate that technology can help link assessment with reform by providing the following functions: support for student work in extended, authentic learning activities; portable, accessible and re-playable copies of performances in multiple media; libraries of examples and interpretive tools; greater participation in the assessment process; and publication of works recognizing student accomplishments (p. 121). Technology can provide evidence of assessment beyond products that are text-based or activities that require the physical presence of the evaluator. Student work can be captured and preserved using interactive multimedia formats that integrate many forms of information on one computer disk (p. 122).

The typical teacher preparation classroom format provides limited time for extended reflection and sharing on the many topics that are covered in each class. Portfolios have been helpful, not only in assessing student performance in teacher training courses, but in helping students reflect upon and organize the material learned in the courses. Developing portfolios electronically provides students with new ways to demonstrate a broad range of abilities, as well as give them greater awareness of the unique capabilities of technology in creating meaningful forms of alternative assessment. A well-designed electronic portfolio system can support this approach and offer expanded potential for collecting different kinds of records of students' work. Final products in a variety of media (text, graphics, video, multimedia), students' oral presentations or explanations, interviews that capture students' development and justifications for their work, and in-progress traces of thinking and problem solving processes can now be included using video and computer technologies.

The use of technology as a tool for assessment of teacher candidates is the focus of an on-going study at two small private California universities. The authors of this paper are developing and testing a system by which teacher candidates computerize their teacher education course portfolios. An electronic portfolio project has been developed to explore the possibilities of using computer technology to store artifacts as evidence of achievement of course objectives based on state certification standards. The electronic portfolio project is being used by students in multiple subjects credential courses as a means of documenting achievement and providing evidence of reflective practice. Templates in both web (HTML) and Hyperstudio formats provide a framework for linking evidence and artifacts to course objectives, teacher credential standards, and useful resources. The electronic portfolio project began in spring of 1998 and research will continues through the spring of 1999, at which time a formal study will be completed.

A preliminary computer literacy questionnaire has been used with all students to examine technical background and student attitude toward technology. Student perceptions of the portfolio process have been explored through interviews and the final portfolio products have been analyzed to determine the effectiveness of the electronic product as assessment. Technological processes within the real-life context of a university computer lab have been examined for problematic hardware and software issues. Personal interviews with teacher candidates have been conducted in an effort to describe and evaluate the electronic portfolio process on an individual basis. The course professors and the computer lab technicians have provided observational data, opinions, and insights into the portfolio process through interviews and e-mail correspondence. A field journal has been kept throughout the project to provide historical record of the researcher's involvement in the process of developing templates for the electronic portfolio project.

The initial electronic portfolio was designed in the spring of 1998. A template was designed based on the course objectives and assignments included in a reading methods course syllabus. The course

professor provided a syllabus indicating how course objectives were linked to state certification standards. The course syllabus included descriptions of all assignments and included guidelines for traditional portfolio preparation. The portfolio designer began with the assumption that HTML web authoring offered the most practical format for students because of its cross-platform compatibility and accessibility to HTML editing software through Netscape Gold software browser and editor. In addition, linking course objectives directly to the World Wide Web addresses of state certification agencies seemed to offer possibilities for providing easy access to current standards. A literacy resource packet was also compiled to provide teacher candidates with additional curriculum materials. Technical problems developed immediately because of cross-platform issues. The designer created the web pages on a Windows NT computer and saved all files on a CD-ROM. The web pages did not load properly on the Macintosh Power PCs in the computer lab. The hypertext links were broken due to the fact that files on the NT were saved using long file names. Once all files were renamed in the eight-letter DOS format, all links were operable.

Teacher candidates participating in the first electronic portfolio project were asked to purchase zip disks in order to have adequate storage space for all text, graphics, audio, and video files. The HTML template was transferred to each student's zip disk. Most of the students requested MAC format, but a few students requested Windows format in order to work on the portfolio on their own computers rather than in the lab. When the project was finally introduced, the students indicated that they were overwhelmed with the complexity of the web and confused over the links to the literacy resource packet. The course professor separated the resource packet from the portfolio in an attempt to differentiate between the purposes of the portfolio and the literacy resources. Early in the semester, it became clear that students also were having difficulty using the HTML template. A decision was made to provide an alternative template using Hyperstudio, a multimedia authoring software program. The course designer created stacks for each objective, as well as a main menu stack and an assignment stack. Each stack included a series of cards or pages in which students were to place their artifacts. These artifacts could be inserted as text files within text boxes, graphics files, sound files, or video files. The students appeared to be less intimidated by the Hyperstudio design. Only one student from the original group elected to use the HTML template.

An additional problem emerged with the design of both templates during the first semester. The course professor noted that students were confusing the assignments with the actual purpose of the portfolio, which was to provide evidence of achieving course objectives. The initial portfolio menu design emphasized the course assignments, causing students to think completing assignments meant meeting course objectives. The design was altered to present an initial menu that gave the course objectives greater prominence. Assignments were then placed under a "notes" menu and students were encouraged to use the assignment stack as a means of entering and storing work. The assignments stack could be used as evidence of meeting objectives, but it had to be linked to the appropriate objective stack or the cards could be copied into the objective stack. The new design gave students a clearer understanding of the types of evidence they needed to provide for each objective.

One student did complete an HTML portfolio and several indicated they would be interested in trying the web format if they were to prepare an electronic portfolio in the future. One student indicated that she would have used HTML if she had had more time, but that using Hyperstudio simply proved to be faster. Most students used the Hyperstudio template and worked, for the most part, in the MAC computer lab. Many students did type their text at home and then used the cut and paste options to enter text into their template. Students indicated that they needed considerable help from the lab technician, particularly for scanning and digitizing graphics and sound. Most of the students followed the template and made few changes in layout and design. Several students customized their graphics and one student created animation as a part of her personal philosophy statement. Several students indicated that they preferred the electronic portfolio process over the paper portfolio process. One student stated: "I think electronic portfolios are a lot easier to look at because you can go to exactly where you want and you can find it right where you want it. You don't have to flip through tons and tons of paperwork." Another student indicated that, with the electronic portfolio, "you really strive to pick the quality things that are going to fit" whereas in paper portfolios "you're just tossing papers in."

Several changes were implemented for the second group of reading methods course students who began portfolios in the fall of 1998. The California Advisory Task Force on Teacher Preparation for Reading Instruction (RICA) prepared new standards that needed to be implemented into an updated course syllabus. The course professor reorganized objectives, added RICA goals to accommodate changes in state certification standards, and simplified the template design. Students were expected to make connections between the RICA goals and the course objectives. Other changes in the project included the addition of

Saturday technology workshops in which students worked with the software and hardware in the computer lab. Students were required to attend for at least one four hour session during the semester. The weekly computer hours were extended, allowing students more time on the computers with the assistance of the lab technician.

The assessment of the fall semester electronic portfolios is not complete, but it is clear that the content of the portfolios demonstrates more meaningful collection of artifacts aligned with course objectives. The first group reported that evidence selection was determined primarily by the ease of being able to digitize and insert the artifact into the Hyperstudio stack. Artifacts from the second group were more complete and the portfolios were more elaborate and personalized. Students demonstrated less frustration over the electronic portfolio process throughout the fall semester. For the most part, students reportedly kept up with assignments and did not wait until the last minute to work on the project. The course professor did not introduce the literacy resource packet until the portfolio project was well under way, resulting in less confusion over the purposes of the project. The students also had the advantage of viewing student projects from the previous semester. One student elected to use the HTML template rather than the Hyperstudio template. Complete analyses of the fall portfolios and student interviews will be conducted during the next semester.

Electronic portfolios were introduced in a beginning "Foundations of Education" course in a teacher training program in the second university setting. The computer lab at this university academic center included ten Windows 95 computers. Because Hyperstudio software was not available, students in this course used the Netscape Gold Browser and Editor to create an introductory web page. A simple template was designed which enabled students to insert a photograph, a letter of introduction, resume, a personal philosophy of education statement, favorite web links, and reflections on research articles. The purpose was to provide beginning teacher candidates with an introduction into the use of computer technology. No attempt was made to link evidence to course objectives or gather additional artifacts relating to their educational experience, although several students did go beyond the scope of the project. Students brought disks of their text files from their home computer. Graphics were digitized using a video capture board and a digital camera. Several students managed to customize their portfolios on their home computers. Students were given the option of having their portfolios posted on the university web server. Students generally indicated that they were pleased with their portfolio product and all but one person chose to put their portfolio on the web. Their perceptions of the portfolio project are in the process of being assessed.

Studies are currently being conducted on the use of electronic portfolios in a course entitled "Teaching and Learning in the Culturally Diverse Classroom." This course is designed to be the final class for multiple subjects credential students before they begin student teaching. Students are creating HTML portfolios based on the six evaluation domains of the California Commission on Teacher Credentialing (CTC). CTC published The California Standards for the Teaching Profession to be used to "guide, monitor, and assess the progress of a teacher's practice toward professional goals and professionally-accepted benchmarks" (p. 4). The California standards relate to six categories of teaching practice:

- Engaging and Supporting All Students in Learning
- Creating and Maintaining Effective Environments for Student Learning
- Understanding and Organizing Subject Matter for Student Learning
- Planning Instruction and Designing Learning Experiences for All Students
- Assessing Student Learning
- Developing as a Professional Educator

Students have collected artifacts and prepared written reflections as evidence of meeting the criteria for each of the six evaluation domains. Students have incorporated text and digitized images of curriculum projects. Students have included various types of lesson plans, including a SDAIE lesson plan and a multiple intelligences lesson plan. They have created thematic unit lesson plans and web pages using the Netscape Gold Editor, the Netscape Communicator Composer, or Microsoft Word 97. These students also included the traditional portfolio artifacts: a letter of introduction, resume, a philosophy education statement, and a research paper. Students will be interviewed and portfolios will be analyzed at the end of the term.

Electronic HTML portfolios are being created by teachers enrolled in a "Computer Applications in Education" course. These students are in the process of meeting the California clear credential requirements for computer proficiency. The portfolio template was designed to show evidence of meeting

course objectives relating to teacher productivity, desktop publishing, computer graphics, software review, e-mail communications, on-line research, web sites useful for instruction, and acceptable use policies. Students were able to save Powerpoint Presentations as a part of their portfolio web. Results of this study also will be available at the end of the term.

Electronic portfolios appear to have potential as tools for assessment. Many students stated that they were overwhelmed with the idea of doing an electronic portfolio when they first started the project. All of the students interviewed indicated that they became more proficient with technology and that they would be interested in doing an electronic portfolio again. Most of the students indicated that they felt they would use their improved computer skills in the classroom. The electronic portfolio project is an on-going study at both universities. The researchers will continue to work on improving the design and implementation of both the electronic process and the portfolio product. The NCATE task force encourages teacher training institutions to provide teachers who are technologically prepared for the 21st Century stating that "today's teacher candidates will teach tomorrow as they are taught today" (p.4). One of the greatest advantages of infusing technology into teacher preparation courses through the electronic portfolio process is that students demonstrate greater confidence in being able to use computers in their future classrooms.

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Computer Driven Assessment and Goal Development : Implications for Higher Education

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Abstract

The Individuals with Disabilities Act (IDEA) mandates that an individualized education program (IEP) be formulated and implemented for each student identified with a disability between the ages of 3 and 21. This paper identified various computer software programs that can be used to assess behavioral, academic, social and adaptive behavior skills of students with disabilities in order to develop an effective IEP and monitor student progress. Computer driven software enables special education teachers to quickly ascertain weak areas. By pinpointing areas of weakness or deficiency, the data gathered from such assessment tools become a valuable source of information that aid in the development of appropriate goals and objectives for the student with a disability. This paper will discuss some of the outstanding computer disks available in the field and their function within the context of special education. The basic premise of special education is the development of goals and objectives for Individual Education Plans and remediation. This paper discusses the use of computer software for the development of behavioral, academic, social, adaptive behavior and other goals and objectives. Computer driven software enables special education teachers to quickly ascertain weak areas, and focus rapidly on areas of weakness or deficiency.

The field of special education is large and is rapidly growing. With inclusion , mainstreaming and other legislative mandates, more and more students are being recognized as having handicapping conditions and are receiving a free appropriate education. Part of their Individual Educational Plan is the development of goals and objectives. These goals and objectives may be in academic areas, or they may be adaptive behavior, social, vocational or the interpersonal realm. Computer driven disks provide teachers with a quick rapid way to ascertain strengths and weaknesses and some computer programs focus on specific areas of weakness.

This paper will review a number of software programs that may help facilitate the goal and objective process. This paper will inform the reader as to the various packages available for teachers in the field and enlighten special education teachers as to the number of computerized assessment packages available. In fact, many special education teachers are laboring long and hard over student papers and administering tests in a one to one fashion, when they could be quickly and easily evaluating students via a number of easily administered assessment devices.

The Realm of Educational Assessment

In the past, academic and achievement testing was along, tedious, laborious process. At the current time, however, there are a number of computer disks that eliminate the time consuming process of going to manuals, looking up students standard scores, percentile ranks, normal curve equivalents, grade and age equivalents and the like. Some disks in fact, print out an entire report for record keeping purposes and documentation. The Mini Battery of Achievement is one such computer disk. The Mini Battery of Achievement (MBA) is a test of basic skills encompassing reading, writing, mathematics and factual knowledge. Basically, after a teacher or guidance counselor or other professional administers the test, raw scores simply have to be entered, and the computer disk will type up a neat report with age equivalents or grade equivalents, percentile rank and standard scores. In addition, the date of testing and the child's age is included for documentation purposes. The MBA enables teachers to monitor progress from the beginning to the end of the year, and relies them of the onerous burden of having to look up scores in manuals and turn to various tables and charts to procure the necessary information.

The K- TEA (Kaufman Test of Educational Achievement) is another test of educational achievement, but it focuses on reading decoding, reading comprehension, spelling, mathematics application and mathematics computation. The computer provides a standard score, allows teachers to choose a band of error, and indicates Significant differences between subtests. Most importantly, an error analysis summary is provided. Teaching objectives can be displayed and printed out and space is left for the Number of problems that will be used to assess mastery and the acceptable error rate for the performance of tasks used to assess mastery.. The K-TEA Assist Manual provides sample materials for teachers to employ. The Peabody Individual Achievement Test-Revised ASSIST is another computer program which helps teachers to assess general information, reading recognition, reading comprehension, math, spelling and written expression. A standard score profile is established for review and subtest comparisons and narrative formats are available. Narrative reports are particularly important for parents who may not understand all of the statistical elements and aspects of achievement testing.

The Wide Range Achievement Test- III also has a computer disk for scoring purposes. This disk saves time, effort and energy and allows a teacher to assess and evaluate a large number of students in a brief period of time. While the WRAT-III is not as comprehensive or detailed, it is simple to administer and the computer will rapidly produce a report from the raw scores.

Adaptive Behavior Assessment and Behavioral Assessment

The Vineland Adaptive Behavior Scales can be administered by a well trained aid and other para professionals can be trained to enter the raw scores into the computer program. The Vineland Assist program provides an Individual Information Summary, Adaptive Behavior Standard Score Summary, an Adaptive Behavior Domain Analysis and a Narrative Report. Domain comparisons enable special education teachers to focus quickly and precisely on specific areas of weakness or need. Such reports provide documentation of growth (or lack thereof) and also serve many other useful functions.

In some instances it is imperative to procure, exacts specific information. The Vineland enables record keeping and the I.E.P. team can monitor growth and development. There are three forms of the Vineland, the Classroom Edition, Survey Form and the Expanded form. These assist in the assessment of adaptive behavior in a variety of realms- communication, daily living skills and in some instances, motor skills and maladaptive behavior.
The BASC (Behavior Assessment System for Children) by Cecil Reynolds and Randy Kamphaus enables special education team to evaluate children with possible behavior problems. Internalizers and externalizers can both be evaluated by this instrument and DSM-IV relevant categories can be inferred. The BASC does not replace an evaluation by a psychologist or psychiatrist, but it does provide a wealth of pertinent, relevant information for diagnostic purposes and documentation and enables the I.E.P. team to examine closely key, crucial areas of concern.

The computerized assessment of Attention Deficit Disorder is another domain that has recently expanded by leaps and bounds. The Test of Variables of Attention is a continuous performance test developed by Lawrence Greenberg that can assess both auditory and visual attentional problems. It can be quickly and easily installed and can quickly validate in an objective fashion, what special education teachers, and parents already know. That is, that a specific child may be impulsive, hyperactive, or have attentional difficulties in either the visual or auditory realm.

There are computerized report writers for children's intellectual and achievement tests. The Computerized Report Writer for Children's Intellectual and Achievement Tests is a computer program to facilitate the entire assessment process.
This interprets the WISC-III/WISC-R, K-ABC, WRAT-R, Woodcock Johnson Achievement Test-Revised, the Stanford Binet- Fourth Edition, PIAT-R and WPPSI-R. However, it comes with a hefty price tag and it's relevance to classroom functioning is questionable.

The Brigance is probably the most well known assessment tool that is used by special educators . It is a criterion referenced test that evaluates a wide range of skills and abilities and it provides and on going record of growth, progress or the lack thereof.
The field of computerized I.Q. testing is also growing rapidly. At the current time, one intelligence test can be given by computer and is rapidly computer scored. The Comprehensive Test of NonVerbal Intelligence is published by Pro Ed and it is certain to alleviate some of the " subjective " problems that are often discussed in cognitive assessment circles. A good teacher can infer from the results domains of weakness and hopefully make some suggestions for remediation.

For specialists in reading, the Woodcock Reading Mastery Tests- Revised
Has a computer program that will score the test , freeing up teachers to do other more productive things.
For those working with students who have receptive language difficulties, the Peabody Picture Vocabulary Test is now in it's third revision and there is a AGS COMPUTER ASSIST. The PPVT-III remains very simple to administer and as special educators

become more aware of the influence of language , this domain may become increasingly important.

There is an ASSIST for the Expressive Vocabulary Test which is also published by American Guidance Service. This enables special educators to asses both expressive and receptive language and compare and contrast strengths and weaknesses.

In the areas of social skills, the Social Skills Rating System provides clear specific, exact, precise behavioral objectives and suggestions for planning intervention. It has eight different report options and the Social Skills Rating System is often appropriate for emotionally disturbed, or learning disabled children.

The Key Math Diagnostic Test-Revised has a compute Assist package that will convert scores and leads teachers to the IEP and the resources of the Key Math Teach and Practice Program. This diagnostic test enables special education teachers to pin point areas of weakness, and remediate them with the Teach and Practice Program. Many regular education students can be helped with these two programs to succeed and excel in math.

Summary and Conclusions

This paper has cursorily reviewed a new domain in education i.e. that of using computer driven software to facilitate the goal and objective process. Both regular education teachers and special education teachers will increasingly need to be computer literate and be able to rapidly and efficiently evaluate student skills and formulate goals and objectives for I.E.P. and classroom use.

Preservice Teachers Become Mentors

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Abstract: This report reviews measures being taken at a small university in Texas to provide a program planned to stimulate preservice teachers to become catalysts of change within elementary schools.

A recent e-mail message provided the stimulus to write this paper. The message described a visit to a kindergarten class equipped with four networked computer stations that are regularly used by five year olds to reinforce concepts learned in class and to do problem solving. The students displayed an amazing comfort level with the computers and a genuine interest in using them. During "show and tell," the "VIP" of the week first showed a color printout from a computer simulation he had on his home computer, then a toy dog and his favorite bear doll. He talked with the same comfort level about all three. I wonder if this student's enthusiasm toward technology will be given a chance to flourish or will it be replaced by boredom as he is exposed to traditional instruction.

In 1996, President Clinton launched a national mission to make every young person technologically literate by the 21st century. This daring challenge to teacher educators required a realistic evaluation of where schools are today, where they are headed and how they intend to get there. Studies have shown a great disparity in the types of technology and its application within and across schools and districts. Archer (1998) reported many educators claim to be convinced that technology could be an enhancement to instruction. In a national survey of 811 teachers and administrators, 78% said they have seen increased achievement as a result of their schools' technology purchases. Of these respondents, 60% said they have seen increased student motivation, 42% better content mastery, and 30% better scores. However, only 37% said their school's instructional software was "consistently integrated" into the curriculum. Norton (1998) stated that technology has joined radio, teaching machines, television and other educational innovations that were identified as "engines of change" as they became integral components of the teaching/learning process. Some educators wonder, since none achieved these original expectations, will technology follow the same path?

The need to be technologically literate grows more urgent every day because of the rapid expansion of information. Large (1984) stated that more information has been produced in the last 30 years than in the previous 5,000 and that printed knowledge is doubling every eight years. To function effectively in the new global society teacher and student preparation programs must develop ways to present knowledge in dynamic, challenging, and encompassing manners using up-dated strategies and cutting-edge technology.

In the past 20 years billions of dollars have been appropriated for educational technology. Today, policymakers and the public are finally starting to demand evidence that their investments have been worthwhile. Gathering the evidence that shows students benefit from a high technological environment is a multidimensional task.

Norton and Weberg (1998) claim that making technological choices depends upon students' ability to recognize the tools and techniques that are available to humans to shape the world in which they live. This student learning is not accidental; it is the result of carefully planned learning experiences.

The experiences employing technology infusion across the curriculum content should: 1. Contribute to the development of quality educational programs; 2. Be fully integrated into the curriculum; 3. Produce teachers competent in developing, incorporating and implementing this cutting-edge knowledge throughout

the curriculum; and 4. Combine the resources of educators, researchers, program developers and teachers. Trotter reported, in 1998, that all states and many school districts have technology plans in an attempt to reach these goals; however, the quality of these plans varies widely. Teachers often fail to make use of available tools. It seems as if the use of technology has evolved partly through the efforts of a small number of teachers and administrators who were anxious to develop new teaching methods.

The two basic questions these educators and policy makers need to ask are: 1. How can computers and other technologies make a difference in learning? @. How can we use these to improve and stimulate learning? Jones and Paolucci (1998) claim the answer to these questions, based on scientific research, seems to be mixed and inconclusive. Education, at all levels, has long been plagued by the need to find a balance between the teaching of skills and the basic teaching of knowledge. The current applications of technology reinforce this lack of balance. Studies by Levy, Navon, and Shapera (1991) have found that in many schools where the majority of students are of lower socioeconomic status, drills and practice programs comprise the highest percentage of computing assignments. These are the very students who should be exposed to structured, organized, meaningful pursuit of knowledge in all areas; students empowered to access and make choices from the vast realms of information that enriches thought and creativity (Woodrow, 1998).

Norton and Weburg (1998) believe the electronic technologies should become an integral part of the teaching and learning process, just as they are increasingly integrated throughout the nonschool experiences of today's students. There is a strong belief among educators that this instruction should be incorporated across the curriculum and at the earliest educational levels (Carbonaro, 1997). Such integration should increase if teachers implement new learning experiences based upon the six instructional principles of : 1. Posing problems of emerging relevance to students; 2. Structuring learning around primary concepts, 3. Seeking and valuing students' points of view, 4. Adapting curriculum to address students suppositions, 5. Assessing student learning in the context of teaching, and 6. Choosing tools and activities that afford a variety of opportunities for constructing knowledge (Norton and Weburg, 1998).

Meeting technology accountability demands that schools employ teachers who can meet the needs of their students. Teachers must learn to understand and be completely comfortable with computers and multimedia technology. There is a recognized need for substantive staff development that is sustained long enough to be effective and conducted by technology leaders experienced with the learning needs of students (Blueprints, 1998).

Workshops and in-service programs are increasingly being provided to assist teachers. The best are not one-shot programs but those that are conducted over a period of time necessary for learning, reinforcement, and curriculum inclusion to take place. Even this fails in some cases because of teachers who are not interested, ambivalent about the benefits that can be attained, or have a general lack of knowledge (Trotter, 1997). A poll of 582 teachers conducted in 1993 by the Global Strategy Group for Jostens Learning Corporation found that 71% of the respondents said basic computer training was available. However, the proportion dropped to 48% when respondents were asked whether they had access to training for integrating computers into classroom instruction (Zehr, 1997). This emphasizes the need for instruction to be developed based upon Dwyer, Ringstaff, and Sandholtz's 1990 work finding that teachers who participate in efforts to bring technology to learning undergo a 3 year process of growth. During the first year they learn to use technology as well as its use in the support of their traditional curriculum and methods of instruction. During the second year, teachers begin to discover that they can cover their usual curriculum faster with technology and, as a consequence, have extra time to experiment with restructuring learning. By the third year, the majority of teachers begin experiencing a fundamental shift in their view of teaching.

To meet this challenge, Texas has adopted standards to assure the development of technology literate individuals who possess the knowledge and skills to solve problems, make decisions, and become lifelong learners as they mature in a society driven by and dependent on emerging technologies. These curriculum components were adopted by the State Board of Education in 1997 and are known as the Texas Essential Knowledge and Skills (TEKS). They consist of basic understandings, knowledge and skills as well as performance descriptions required of K-12 students. Teachers are expected to integrate these requirements

into the curriculum during the 1998-1999 school year and will be held accountable for student performance on the Texas Assessment of Academic Skills (TAAS), which is the standardized test used by the state to evaluate student achievement for graduation from high school. The primary measure of the effectiveness of the program will be evaluated by student outcomes.

This latest mandate is forcing school districts, schools, and personnel to review the current status of their programs and develop ways to ascertain cutting-edge instruction for all students in the many areas of technology included in these TEKS requirements. Recently, I became aware of the importance of areas covered in the TEKS when a pre-service teacher stated the technology requirements for primary grade students include areas she learned in a high school honors class. These items were required for high school graduation and now they are being taught in the elementary school.

Texas requires districts to submit technology plans before receiving state funds for technology. To properly use the purchased materials, states should require incoming teachers to have technology training or the expertise in order to obtain a teaching certificate. Texas requires a three semester hour course in technology for teacher education students. The U.S. Department of Education recommends that states include the ability to use technology effectively, and that teacher education institutions ensure that their graduates meet these requirements for licensure and advanced certification. In view of these educational changes, Schools of Education are being forced to re-evaluate their teacher education programs. Charp (1994) reported that teacher education programs requiring computer literacy for all students have increased, although slowly. Faculty involved in teacher preparation programs are being forced to assume that if pre-service teachers are to integrate technology during their field work, student teaching, and initial classroom experiences they, too, must be prepared to assist and model for all who study with them. This change is vital to the college programs. In the near future, the success or failure of the teacher preparation programs will be determined by the number of pre-service teachers who successfully pass the state certification test. Too many failures in an area will result in the elimination of that preparation program.

Aware of the stated factors, the faculty of St. Mary's University determined changes were needed in parts of our Teacher Certification program to assure that our students would use available technology materials to develop critical analysis skills in their students. Faculty members, while visiting public schools, had noted unused computers in rooms, learning stations in halls, and lab periods devoted to drill and practice activities.

A survey on use of technology was developed by Davenport and Smith and distributed to teachers in cooperating schools. These schools are representative of the South Texas area and include students of extremely diverse economic and cultural backgrounds. We were aware that these teachers have numerous opportunities to attend workshops, in-services, and various meetings that provide training in technology. We were not surprised by the survey results. (Davenport, 1998). They reaffirmed the previous research presented in this paper. Tape recorders, VCRs, and Camcorders were the most frequently used technology. Creation of databases, digital graphics and animation, trouble shooting, and electronic search strategies were the least used. As we reflected upon these results, we concluded that it was the preservice teachers who needed to become technology agents of change.

The first step taken to train these new mentors was the development of a new technology course directed toward education majors and taught by the computer department. The course will teach advanced skills as well as requiring the embedding of these skills in unit and lesson plans in academic content areas. All interested faculty have been invited not only to contribute suggestions for content inclusion but to become active participants in this course, providing them the opportunity to learn or review their technology skills. Preservice students will then be required, with the supervisory teachers' approval to "try our" these strategies during their field work. By providing these models for inservice teachers, we hope to trigger the teachers' interest in using these strategies to enhance critical analysis.

The necessity to demonstrate state requirements should compel teachers and students to select data, comprehend material, and then communicate this information in numerous ways. Student-centered learning implies active collaboration, using prior knowledge as a foundation to develop authentic projects employing critical analysis skills. The following activities have been identified as a means of enhancing

learning in the St. Mary's elementary education courses; enabling pre-service teachers to share their knowledge with inservice teachers during their field work, student teaching and future professional assignments.

Course: Classroom Management in the Elementary School

1. Professional development programs produced by the Developmental Center for Handicapped Persons, Utah State University.
   a. Curriculum Based Assessment and Behavioral Intervention Approach to Learning and Behavior Problems in the Classroom
   b. Effective Instruction: Techniques for Classroom Interaction
2. Development and placement of student resumes on St. Mary's Career Services Web page.
3. Development of a professional technology portfolio.
4. Establishment of a grade book: alphabetizing, grade entry, absences, tardies, six-week evaluation, final evaluations, with various assigned weights for tasks.

Course: Reading - Language Arts

1. Creative writing using the writing process.
2. Classroom newspaper
3. Investigate e-mail contacts to exchange comprehension/vocabulary development ideas
4. Produce banners to publicize special celebrations
5. Create bulletin boards using technology developed materials
5. Reading Magic Library

Course: Essential Elements of Social Science

1. Use of www to research topics
2. Timeliner program to review/recap events
3. Graphing programs
4. Power Point, Word, or Hyper-Stack for the development and presentation of unit plans
5. Oregon or/and Yukon Trail
6. Carmen San Diego
7. The Alamo - CDROM
8. Campaign Trail - Tom Snyder
9. World View - CDROM
10. Texas Trivia
11. Colonization - Tom Snyder

Course: Child Development: Pre-School and Elementary

1. Development of multi-media program
2. Development and completion of surveys
3. Scanning materials for presentations
4. Video production

Course: Reading - Methods

1. Vocabulary searches
2. Puzzle-maker
3. Develop flyers
4. Prepare copy for handouts, worksheets, and transparency masters
5. The Case of the Missing Mystery Writer
6. Development of WEB pages

Course: Reading - Teaching Reading in the Content Area

1. Use of WEB site resources
2. Evaluation of software for the content
3. Development of templates for lesson plans and activities

Course: Essential Elements of Life-Earth Science

1. Use of Hyper-stack, PowerPoint, Word for unit development and presentation
2. Data entry, spreadsheets, graphs, tally sheets for program development
3. Develop and use of templates for lesson plans and activities
4. Animal Zoo Program - CDROM
5. Prehistoria - CDROM
6. Grolier Encyclopedia - CDROM
7. National Parks - CDROM
8. Science Trivia
9. Wildlife Trivia
10. The Great Solar System Rescue - Tom Snyder
11. The Environment - Tom Snyder
12. Windows on Science

Course: Children's Literature

1. Creative writing programs with illustrations: Once Upon a Time or Story Writer
2. Develop and publish chapter books
3. Install author pages on WEB sites
4. Multimedia Literature - CDROM
5. Timeliner program
6. WEB resource searches

Course: Reading: Psycholinguistic Foundations

1. Produce working portfolios to include:
   a. Evaluations of students
   b. Project development
   c. Use of a grading program
   d. Writing, designing, publishing, and distributing a book

Course: Essential Elements in Math II

1. Development of word problems using pictograph and other graphing materials
2. Math Blaster
3. Math Finder
4. Math Rabbit

Course: Instructional Planning, Assessment and Evaluation

1. Paperless course: syllabus and handouts on WEB
2. E-mail discussion groups, national and international
3. Power Point presentations and on discs
4. Spread sheets
5. Grading programs
6. Databases

Plans are already underway to develop a second stage survey to compile data that studied areas that have been successful, those needing further development, and those that failed to achieve the stated purposes. The opportunity to share this information might present itself at a future date.

Although technology has not profoundly revolutionized teaching and learning there have been changes. We must remember change does not come easily, cheaply, or quickly.

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Creating a Web-based Course for Undergraduate Pre-Education Students

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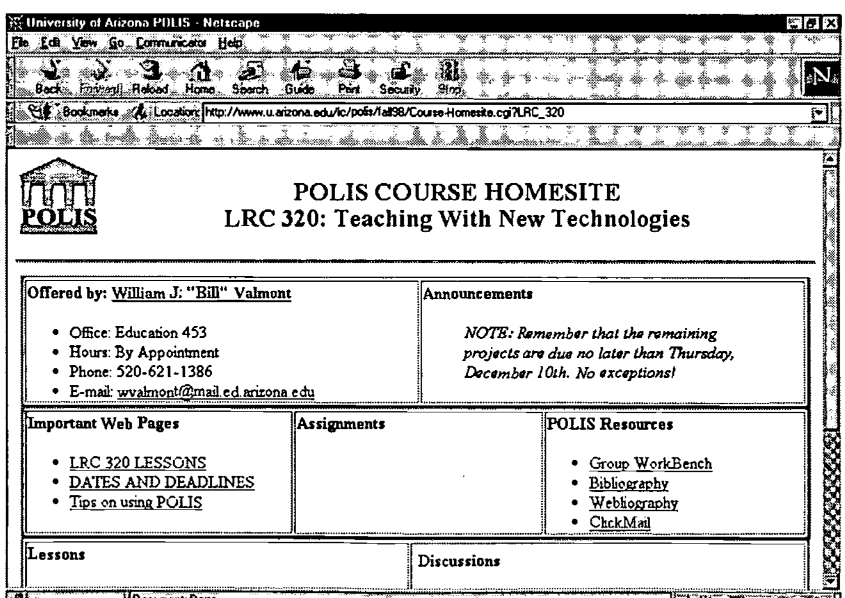
Abstract: A grant from the Corporation for Public Broadcasting led to the creation of an introductory, web-enhanced technology course for undergraduate students who wish to become teachers. The course was first offered during fall, 1997, was revised throughout spring, 1998, and was re-offered in the fall, 1998, semester. This presentation describes the course that uses both a POLIS (Project Online Instructional Support) web-based course HomePage as well as materials placed on the College of Education's server. The features of POLIS and course projects are described. Pre-course-measures of students' knowledge of technology are presented. Post-course findings can be found online.

1. Introduction

LRC 320, Teaching With New Technologies, is a course currently being offered at the University of Arizona. The course originally was developed in 1995 as a lecture and demonstration class that would introduce undergraduate students who might be interested in becoming teachers to some of the basics of teaching. How technology can be used to help school-age students learn would also be stressed. Because of a grant from the Corporation for Public Broadcasting, this writer began working with a small group of students and other interested parties to develop online materials in order to make the course more effective. In the fall of 1998, twenty students took the technology-enhanced version of LRC 320. The revised course is discussed below.

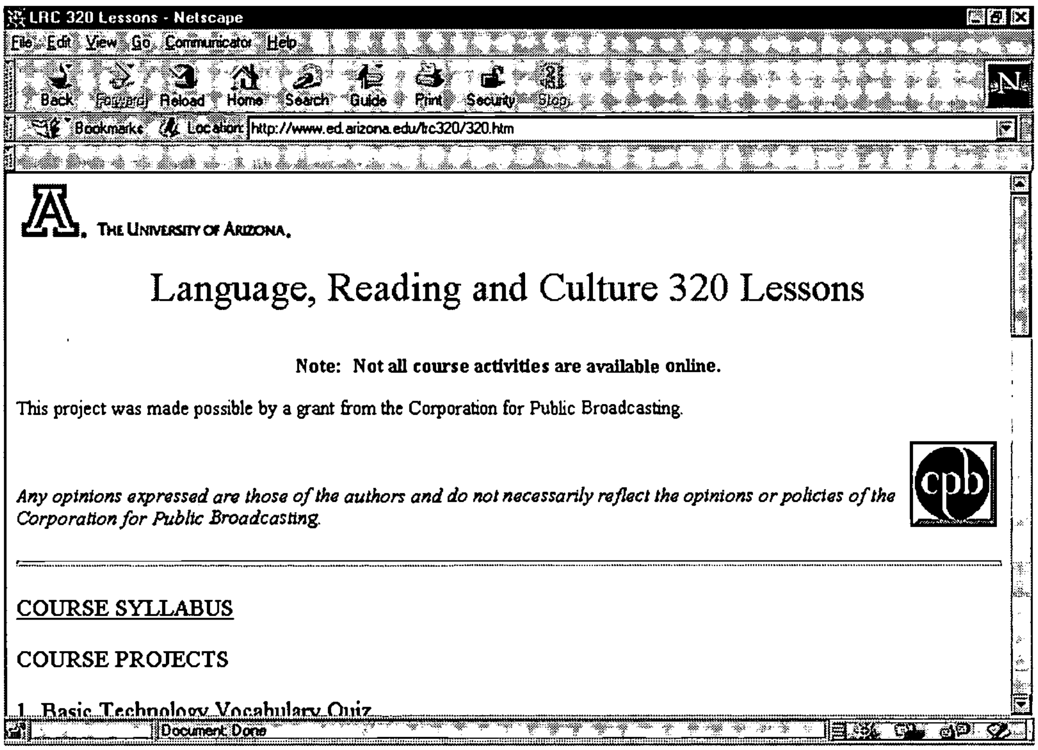
2. Course Homesite

Dr. Sally Jackson is a professor at The University of Arizona in the Department of Communications. She is the developer of POLIS, an acronym for Project Online Instructional Support. POLIS is a complex computer program that enables University professors to create, from a template, course homesites. The URL for POLIS is: http://www.u.arizona.edu/ic/polis/.



Some of the major features of POLIS are as follows: (1) instructors can place basic course information on the course homesite, (2) instructors can link to other web pages containing, for instance, a course syllabus, (3) the course homesite enables instructors to place announcements in a conspicuous place, to list assignments, as well as to identify lessons and either threaded or unthreaded discussions, and (4) POLIS resources are easily used for communication. POLIS resources consist of the Group WorkBench, an area of the homesite in which students can communicate with each other in small groups; the Bibliography, to which both the instructor and the students can contribute; and the Webliography, which both students and instructors can use to add pertinent web sites to the course homesite.

Using the instructor's tools of POLIS, Teaching With New Technologies (LRC 320) was created and revised. In addition, the College of Education's Media Specialist Senior, Brian Grove, and I developed materials for the course that were housed on the College's NT server. Those materials can be found at this URL: http://www.ed.arizona.edu/lrc320/320.htm.



Course projects include: a lesson about basic technology vocabulary followed by an online quiz; the parts of a personal computer; a lesson in how to create a HomePage using the University of Arizona's e-mail and homepage system; lessons helping students conduct internet searches, particularly when they want to locate lesson plans and educational web sites. In addition, lessons dealt with educational uses of databases, spreadsheets, and multimedia authoring software.

3. Course Structure

Students met with the instructor on Tuesdays for 75 minutes for the purpose of learning how to use POLIS, to clarify assignments, and to discuss topics that did not lend themselves well to on-line discussions. The wide-ranging group of topics discussed included: copyright laws, ethical use of the Internet, student and parent Internet usage forms, professional web sites for educators, elements of web design, storyboarding, using digital cameras and/or digital video, viruses and virus protection, database and spreadsheet construction. Demonstrations of Internet audio and video were given. Other demonstrations included a chat with an individual in another state through the use of NetMeeting, conducting Internet searches, making multimedia

presentations, and many other applications. The instructor related technology applications to teaching wherever possible. At the end of the course students, who had created their own homepages, took their classmates on a tour of their web sites. They also shared a multimedia project with their classmates that they developed using Hyperstudio. Students also had an ongoing assignment to e-mail to the instructor each Friday two new vocabulary words they had encountered that week.

On Thursdays, most students visited the College's Instructional Technology Facility (ITF) where they could receive individual or small group assistance from the Media Specialist Senior or the instructor. While attendance was *required* at Tuesday's classes, students could work from home, the dorms, or elsewhere if they chose on Thursdays. Participation on non-discussion days was quite high throughout the semester, although three students were rarely seen on Thursdays.

Nine of the students in the class were in their senior year at the University of Arizona. Five students were in their junior year. Five students were sophomores, and one student was an unclassified graduate student. One student, a junior, stopped coming to the class after the first few weeks, leaving 19 who completed the course. Ten of the students were identified as pre-education majors, and five students were identified as elementary majors. Four students were working toward Bachelor of Arts degrees, one each in anthropology, communications, political science, and psychology. The remaining student was the unclassified graduate student. Sixteen students were females and four were males.

4. Pre-course Familiarity with Technology

At the beginning of the course, students were given a technology survey. Sixty-seven percent of the students indicated that they own a computer. Eighty-nine percent had experience with computers. Students were asked a series of questions about various computer applications. For each application, students were asked to indicate whether they were unfamiliar with, made limited use of, or made frequent use of the application. Then, for each application, students indicated whether or not they were prepared to use that application with students in an instructional setting. Students reacted to questions about the following applications: word processing programs, databases, spreadsheets, statistical programs, CD-ROMs, multimedia applications, telecommunications, electronic mail, electronic bulletin boards, file transfer protocol, SABIO (a library search program used at the University of Arizona), Netscape Navigator or Microsoft Explorer, graphics programs, desktop publishing, software for subject/teaching areas, probeware, image processing, scanners, camcorders, video editing, VCRs, videodiscs, calculators, teacher utility programs, or authoring languages.

As might be expected, students reported frequent use of only the following: VCRs (67%), calculators (67%), e-mail (61%), Netscape or Explorer (39%), and word processing (33%). These students indicated that they frequently used the applications and felt prepared to use them in their future teaching. Students indicated *limited* use of SABIO (44%), spreadsheets (44%), and Netscape or Explorer (39%). They indicated that they were unprepared to use these applications in their future teaching.

At this point in time, the instructor expected that more of the students in this class would have encountered a substantial amount of interaction with technology in their high school education. It was surprising, therefore, to see such large percentages when students indicated they were *unfamiliar* with all of the other applications. Ninety percent or more of the students indicated that they were unfamiliar with authoring applications (100%), probeware (100%), desktop publishing (94%), and image processing (94%). With the exception of desktop publishing, the lack of awareness of these other applications, however, is somewhat understandable, given the nature of these applications.

Eighty to eighty-nine percent of the students were unfamiliar with these: video editing (89%), FTP (89%), scanners (89%), graphics applications (83%), and electronic bulletin boards (83%). The remaining applications were less unfamiliar. The levels of unfamiliarity reported were: software for teaching (78%), statistical applications (72%), multimedia applications (72%), telecommunications (72%), videodiscs (61%), database applications (61%), CD-ROMS (50%). At this point, it is apparent that the students were more familiar with the applications they reported that they know about. Fewer students reported that they were unfamiliar with teacher utility programs (39%), spreadsheets (33%), camcorders (33%), word processing (22%), SABIO (22%), e-mail (11%), Netscape or Explorer (6%), VCRs (6%, and calculators (0%).

5. Post-course Familiarity with Technology

At the end of the course, students will be given the same survey they received at the beginning as well as another survey containing items designed to determine their satisfaction or lack thereof of the course and the technology used. Results and an analysis of the post-course assessment were not available when this article was written. However, readers can view the results, conclusions, and implications of this investigation by means attending the conference presentation or clicking on a link from the author's web site at the following URL: http://www.ed.arizona.edu/itf/valmont/wvalmont.htm

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Integrating, Infusing, Modeling: Preparing Technology Using Educators

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Abstract: This paper presents the results of a 1997-98 Goals 2000 Preservice Teacher Education Grant. The program was designed to provide preservice teachers the opportunity to observe expert teachers integrate technology in the elementary classroom through a video conferencing system and to experience the infusion of technology in their education courses. Grant activities were implemented during the 1997-98 academic year. Evaluation of these grant activities was conducted through pre/post surveys, observation, and focus group interviews. Results summarize the impact of grant activities on faculty (N=20) technology proficiency and integration and preservice teachers' (N=61) technology proficiency and understanding of technology integration. Recommendations address program improvement but also methods that any department of education could utilize when attempting to prepare technology-using educators.

Introduction

When I arrived as a new faculty member in the department of curriculum and instruction at SUNY Oswego in 1996, an educational technology course was being offered for the first time. However, most preservice teacher education students were not receiving any instruction on computer applications or integration methods since this newly developed technology course was not a program requirement and conflicted with most education courses. While it was planned to eventually require the technology course for education majors, several studies have concluded that a stand-alone course only develops basic computer skills and does not prepare educators to utilize technology in a variety of instructional settings. In addition, these studies have recommended the infusion of technology throughout education courses and the provision of technology-rich field placements so that preservice teachers observe and experience the modeling of technology integration in numerous settings (Handler & Pigott 1994; Office of Technology Assessment 1995; Wetzel 1993). Unfortunately, due to a lack of equipment and expertise within the department, faculty were unable to model technology use in their courses. Similarly, very few area K-12 classrooms were able to provide technology-rich field placements again due to a lack of equipment and teacher expertise.

In an attempt to jump start technology integration in teacher education, the department of curriculum and instruction developed a program to increase preservice teachers' proficiency in the integration of technology in their future classrooms by providing them with the opportunity to observe expert teachers integrate technology in the elementary classroom and to experience the infusion of technology in their education courses. Funded through a 1997-98 Goals 2000 Preservice Teacher Education Grant, this program created a partnership between SUNY Oswego and two local elementary schools. Primary goals of the grant were to:

- Create 6th grade and 4th grade model technology-using classrooms;
- Train faculty members and participating teachers on techniques of integrating technology;
- Provide faculty with 8 portable computer stations to enable technology infusion in education courses;
- Provide over 60 preservice teachers (enrolled in elementary teaching methods or special education methods) the opportunity to observe through video-conferencing/video technology-rich classrooms.

This paper describes the grant activities in detail as well as the impact these activities had on the education faculty and participating preservice teachers.

Grant Activities

Grant activities were primarily implemented during the 1997-98 academic year. Grant directors were notified of funding in the spring semester of 1997, at which time equipment was ordered and a technology needs assessment was conducted for department faculty and participating teachers. This instrument gathered information on technology proficiencies, level of integration, perceived barriers to technology implementation, and training preferences. Using the needs assessment data, the project directors planned team meetings and training sessions for fall of 1997. Other grant activities during the fall included setting up equipment at the various sites and facilitating team development of technology integration activities to be implemented during the 1998 spring semester in both the participating elementary classrooms and the methods courses. Evaluation of the impact of these technology activities occurred throughout the semester. Description of all grant activities is presented below.

Acquisition of Technology

Since neither the participating classrooms nor the department of curriculum and instruction had the technology necessary for even basic integration activities in the classroom, a great deal of equipment was ordered for all participating sites. Each of the elementary classroom received: 5 desktop PCs, 1 laptop computer, 2 inkjet color printers, color scanner, LCD projector, and networking equipment. The department received 4 PCs (2 desktop and 2 laptops), 4 Macs (2 desktop and 2 laptops) , 8 inkjet color printers, 2 LCD projectors, color scanner, and video-conferencing equipment. Utilization of the video-conferencing system required lines to be installed in the two participating classrooms. Although installation of these lines was initiated at the onset of the grant, after 10 months of attempts the participating phone companies finally admitted that they were unable to provide the necessary lines due to the very rural location of the two sites.

Development of Teams

Two teams were developed to carry out the grant activities and to facilitate a comparison between an undergraduate elementary methods course and a graduate special education methods course. Project co-directors served as team leaders. The Elementary Team consisted of two instructors of the elementary methods course, a 6th grade teacher, and a project co-director. The two methods instructors had limited experience with integrating technology in the classroom and were concerned about the original course content taking a backseat to the focus on technology. One of the methods instructors was an Associate Professor while the other was a newly hired Assistant Professor. Approximately 25 students were enrolled in each methods section for the spring semester and had not taken an educational technology course. This methods course was structured such that students met two days a week for 6-7 hours. Students were in the field for the middle 9-10 weeks and were on campus the first four weeks and the last two weeks. Course content focused on planning, instruction, and evaluation methods in the elementary classroom. Since this course was held during the day, it was planned that students would have the opportunity to observe the 6th grade classroom utilizing a variety of technology applications via the video-conferencing system. The participating 6th grade teacher had recently completed his master's degree in educational technology and maintained a wealth of experience in teaching with technology. Twenty students were enrolled in his rural classroom. The project co-director that worked with this team was in her second year as an Assistant Professor, had moderate experience with technology integration, and was the principal investigator of the grant.

The Special Education Team consisted of one instructor of the graduate special education methods course, three 4th grade teachers, and a project co-director. Again, team members brought various levels of technology experience. The methods instructor was in her fourth year as Assistant Professor, was proficient in several areas of technology integration, and was eager to implement a variety of technology applications in her course. Only 11 graduate students were enrolled in her course and had not received a course on educational technology. This class was offered once a week in the evening and did not require a field placement. The participating 4th grade teachers had very limited experience using technology in the classroom. These teachers taught in an inclusion classroom with approximately 50 students. The project co-director who worked with this team was an Associate Professor and had minimal experience using technology.

Training & Technology Planning

Training on the following topics was provided to all department faculty and participating teachers during the fall of 1997: equipment basics, word processing, database, spreadsheet, Internet and email, content specific software, PowerPoint, HyperStudio, managing technology integration, and assistive technologies. Training topics

were identified in the needs assessment. Sessions attempted to focus on integration methods not just basic skills.

As individuals attended training sessions throughout the fall semester, teams met on a regular basis to develop meaningful and complementary technology activities for their respective classrooms. Team leaders facilitated the scheduling of meetings as well as activity development. However, due to the composition and leadership differences in teams, the frequency of meetings as well as the process of developing technology activities greatly differed. Although the Elementary Team met frequently, development of all technology activities relied heavily on the 6th grade teacher and the team leader. In contrast, the Special Education Methods Team met only a few times during the fall semester and did not develop any technology activities for the 4th grade classroom or the methods course. Instead, the methods instructor independently developed technology-related course and occasionally sought assistance from the Elementary Team Leader.

Implementation

Elementary Team

In general, the Elementary Team experienced two setbacks that greatly influenced the implementation of meaningful technology activities: 1) the methods instructors relied heavily upon the classroom teacher and the Elementary Team Leader to generate and implement technology activities in their courses; and 2) preservice teachers were unable to observe via video conferencing the 6th grade classroom using technology since the phone companies were unable to provide this service. Unfortunately, this wasn't known until halfway through the implementation period, the spring semester. Consequently, technology integration was quite limited in the methods course. Preservice teachers observed through video two technology-related activities in the 6th grade classroom, one of which was reenacted with the preservice teachers. Other technology-related activities consisted of the classroom teacher presenting to the preservice teachers on technology integration ideas, sharing technology-rich lessons and student products, demonstrating several applications, and facilitating student hands-on time with the applications. Preservice teachers also had the opportunity to observe technology being used in their field placement; however most of the field placements demonstrated drill and practice and not tool-based applications.

The 6th grade classroom teacher implemented three technology-related units; each lasting several weeks. For language arts, students created a book review that consisted of a rating scale, a computer-generated illustration, and a word-processed book summary. The reviews were created using a teacher-made template and were on display in the school cafeteria for several weeks. During the 1998 Winter Olympics, students competed in the Mini-Metric Olympics for mathematics, in which game results were organized and computed using spreadsheets. For social studies, students created trading cards of historical figures in Modern Europe. Students utilized Encarta to gather information and created the trading card using a template developed by the teacher. All activities were shared with the methods students either through video and/or handouts.

Special Education Team

The Special Education Team was also limited by setbacks: 1) delayed arrival and configuration of equipment in the 4th grade classroom; and 2) a project co-director that did not schedule and/or facilitate team meetings. Consequently, the participating methods instructor and 4th grade teachers received inadequate support for activity development and implementation. Fortunately, the methods instructor was fairly comfortable in technology risk-taking and thus developed and implemented several technology activities on her own. This instructor demonstrated several technology applications and then required her students to develop lessons integrating technology. Students were also given the opportunity to explore many applications, especially assistive software. In addition, students were required to demonstrate various applications and conduct a poster session on technology-rich lessons. Since the 4th grade teachers were unable to implement any technology activities, the methods course observed through video the 6th grade classroom conducting the Mini-Metric Olympics.

Evaluation

Evaluation activities were conducted throughout the grant period. Pre/post surveys were administered to department faculty (May 1997, 1998), elementary teachers (May 1997, 1998), and preservice teachers (January & May 1998). Surveys measured technology proficiency, use/integration, perceived barriers, training preferences, and impact of grant activities. Training participants also completed evaluations. Observations were conducted of technology activities implemented in the college and elementary classroom. Focus group interviews were conducted with the participating preservice teachers at the conclusion of the grant. Group interviews consisted of 6-10 students and were conducted by the Elementary Team Leader and a trained graduate assistant at field sites and on campus.

Results

Department Faculty Proficiency and Integration

Since all department faculty had the opportunity to participate in the technology training sessions and utilize the 8 mobile computer units, a pre and post survey was administered to all department faculty to determine the impact of these activities on their technology proficiency and integration. Prior to the grant, the majority of faculty reported moderate/high proficiencies in general computer use, word processing, and email. After the grant, faculty reported significant increases in moderate/high proficiency in CD-ROM, distance learning, instructional software, Internet, and instructional methods. Faculty also reported an increase in integration of technology applications: computer presentations, instruction software, drawing, Internet, and word processing (See Table 2).

	C & I Faculty		Elem. Methods Students		Sp. Ed. Methods Students	
	PRE	POST	PRE	POST	PRE	POST
	n=18	n=15	n=48	n=37	n=11	n=10
Computer	88.9	93.3	87.2	86.1	92.9	90.0
CD-ROM	50.0	73.3	51.0	77.8	81.8	90.0
Distance ed.	16.7	46.6	4.2	8.6	0.0	30.0
Scanner	11.1	20.0	14.9	28.6	18.2	50.0
LCD panel	5.6	33.3	2.1	11.1	0.0	20.0
Word processing	94.4	100.0	97.9	94.4	100.0	100.0
Database	50.0	40.0	25.6	51.4	36.4	50.0
Spreadsheet	55.6	40.0	27.6	62.8	27.3	60.0
Drawing	22.2	13.4	25.5	42.9	63.7	80.0
Simulation	0.0	6.7	8.6	14.3	9.1	62.5
Instruction software	22.3	60.0	36.1	50.0	63.6	100.0
Presentation software	22.2	26.7	21.3	25.0	27.3	70.0
Hypermedia	16.7	13.4	31.9	52.8	45.5	80.0
Email	83.3	93.4	93.6	94.5	72.7	90.0
Internet	50.0	73.3	91.5	91.7	72.7	90.0
Instructional methods	27.8	46.7	19.1	36.1	45.5	90.0
Assistive technologies	N/A	N/A	10.6	8.3	0.0	60.0

Table 1: Percent Reporting Moderate to High Technology Proficiency (N/A = Not available)

Elementary Methods Students

Pre and post survey results revealed that preservice elementary teachers reported an increase in the following technology proficiencies: CD-ROM, database, spreadsheet, and hypermedia (See Table 1). These students also reported an increase in the applications they experienced and/or observed in their education courses: computer discussion group, content-specific software, distance education, drawing, spreadsheet, and word processing (See Table 2). Two methods, post survey and focus group interviews, were utilized to determine the impact of specific technology-related activities on students' understanding of a technology-rich classroom. The post survey asked students to rate the degree to which specific activities had an impact on their understanding of technology integration. The majority of students identified the following activities as having significantly contributed to their understanding: simulation of mini-metric Olympics (80.6%), classroom teacher's presentation of technology integration ideas (77.8%), viewing technology rich lesson plans and student products (69.4%), discussion of technology integration methods (61.1%), hands-on experience with various software packages (59.4%). The focus group interviews presented mixed results. Although the preservice teachers saw some benefit in the project in that it provided them with many technology integration ideas, the majority were very disappointed that the 6th grade observation was not done through the video-conferencing system as originally planned. Students perceived the technology focus as an "add-on" to the class that lacked connection to the course, its instructors, and its assignments. In addition, students maintained a vision of a technology-rich classroom as one that has "lots of computers for students to spend lots of time on them playing content-specific games and tutorials"—a scene that was depicted in over 70% of the of their field placements.

	C & I Faculty		Elem. Methods Students		Sp. Ed. Methods Students	
	PRE	POST	PRE	POST	PRE	POST
Computer presentations	16.7	60.0	63.8	77.7	72.2	100.0
Computer discussion group	16.7	26.6	44.7	69.4	27.3	70.0
Content specific software	16.7	46.6	42.6	68.4	18.2	90.0
Database	0.0	20.0	19.1	44.4	18.2	100.0
Distance education	0.0	6.0	2.1	38.8	0.0	30.0
Drawing	0.0	33.3	29.8	58.3	18.2	80.0
Email	61.1	73.3	97.9	94.4	36.4	80.0
Grading program	0.0	33.3	19.1	33.3	27.3	50.0
Home page development	5.6	13.3	38.3	36.1	0.0	10.0
Hypermedia	0.0	6.0	53.2	63.8	9.1	90.0
Internet	61.1	86.6	97.9	91.6	36.4	90.0
Scanner	5.6	13.3	21.3	38.8	9.1	40.0
Spreadsheet	11.1	20.0	29.8	75.0	0.0	70.0
Simulation	0.0	0.0	0.0	30.5	18.2	30.0
Word processing	50.0	93.3	78.7	94.4	54.4	100.0
Assistive Technologies	N/A	N/A	19.1	17.0	9.1	90.0

Table 2: Percent Reporting Experience and/or Observation of Instructor Using Applications in Courses (N/A = Not available)

Special Education Methods Students

Special education methods students reported significant increases in several computer-related proficiencies as well: distance education, scanner, LCD projector, spreadsheet, simulation, instruction software, presentation software, hypermedia, instructional methods, and assistive technologies (See Table 1). They also reported an increase in experiencing/observing all applications in education courses (See Table 2). These master's students felt that all technology-related activities increased their understanding of technology integration, but identified the following as having the strongest impact: poster sessions of technology-rich lessons (90%), PowerPoint demonstration by instructor (60%), process of developing a technology-rich lesson (60%). During the focus group interview, students saw the grant project as very positive and felt that the technology experiences were connected to the course content and assignments. They reported that the project provided many ideas and examples of technology integration that enabled them to advance their vision of technology-rich classroom from one in which computers are used for games and tutorials to one in which computers are used as a productivity tool.

Recommendations

Although the first year of this project may not have produced the kind of results we had hoped, a great deal was learned and improved upon for the second year of the project. The following recommendations address responsibilities for project directors, education faculty, and classroom teachers. While these improvements are specific to this project and are currently being implemented, they can also be viewed as general recommendations for school-university partnerships seeking to develop technology-using educators.

Project Directors

A difficulty in implementing this grant was holding participants, especially faculty members, accountable for assigned responsibilities. This may have been due to the disparity in rank between principal investigator and several of the faculty participants. To ensure that faculty participants fulfill their responsibilities, the principal investigator should clarify expectations of all participants—a process in which participants would identify personal objectives that are aligned with the project goals, develop a timeline for fulfilling those objectives, and periodically reflect upon and review with the director the achievement of objectives as well as the support they have received and

will need in the future.

One of the expectations of the participating faculty and teachers was that they would integrate technology in their instruction. Although training was provided, participants did not have the opportunity to observe technology-rich instruction in the college or elementary classroom. Consequently, several faculty members and teachers experienced difficulty in developing vision of a technology-rich classroom. In addition, the training sessions really provided participants with a smorgasbord of technology applications—most felt they learned "a little bit about a lot of stuff" but were just not comfortable yet with classroom integration. Therefore, to increase faculty and teachers' ability to integrate technology in their instruction, a training program should be designed that provides faculty and teachers with technology-rich site visits as well as facilitates proficiency in 2-3 personally selected technology applications and the development of classroom activities that utilize those applications. Essentially, faculty and teachers develop a personalized plan for integrating technology that identifies: 2-3 applications for proficiency development, a plan for developing target proficiencies, the type and number of technology activities to be implemented, a timeline for accomplishing objectives, and a plan for periodic review. The focus on only a select number of applications is supported by a study conducted by Vannatta (1998) in which she found that technology integration among education faculty was not highly correlated with overall proficiency in numerous applications but rather proficiency in instructional methods of integration and 2-3 applications.

Participating Faculty and Teachers

Although the special education methods instructor received minimal support from her Team Leader and members, she was able to implement numerous technology-related activities in her course that in turn had a very positive effect on her students' technology proficiency and their vision of a technology-rich classroom. The primary difference between the activities implemented in the special education methods course and the elementary methods course was the connectedness of the activities to the instructor, the course, and the assignments. In the special education methods course, the instructor herself implemented and modeled the technology activities throughout the semester. In addition, this instructor required her students to complete several assignments that integrated technology (e.g., develop lessons that integrate technology, review software, demonstrate different applications, share technology ideas). In contrast, activities implemented in the elementary methods course were primarily taught in isolation by the Team Leader and the 6th grade teacher. Furthermore, the methods instructors did not connect these activities to the course content or assignments; consequently students did not see the relevance in the technology activities but rather felt that the technology focus detracted from the course content necessary to complete assignments. Therefore, in order to improve the modeling of technology integration in education courses, faculty should: model technology integration themselves, require assignments that integrate technology, have students develop lessons that integrate technology, discuss technology integration throughout the course, discuss different uses of technology (tutorial vs. productivity), and provide opportunities for students to share technology-rich lessons with each other.

Recommendations for improving the technology integration among the participating classroom teachers are similar to those previously stated for the faculty. Essentially, allow teachers to develop a personal technology integration plan and have teachers visit the education courses to share their experiences with technology integration.

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How to Prepare Teachers for the Next Century: Case Studies of Innovative Use of Technology in Pre-service Teacher Education

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Abstract: Innovative use of technology in education is becoming more of a necessity for present day education. Teachers need to be well prepared for the new demands posed to education in the 21st century. Three major directions of innovative use of technology in pre-service teacher education have been studied using a case study approach. The examples are examined from the perspective of their underlying rationale, their instructional characteristics and their sustainability.

Conceptual Framework

Three major reasons for using technology in education are always mentioned: new demands from society (meta-cognitive skills, information management and social skills), a new approach to teaching and learning (constructivism) and technology use for solving problems in present day education (drop-outs, individualized education, poor transfer of school knowledge to real life) (Office of Technology Assessment, 1995; Panel on Educational Technology, 1997; Watson, 1996). Use of technology in education contributes to at least one of these motives, but more often to a combination.
Itzkan (1994) distinguishes between three stages of technology use in education: substitution (technology as replacement for tasks of the teacher), *transition* (use of technology requires a change in teaching practices), *transformation* (a change of the rationale underlying education).
Learning is no longer considered as the pure transfer of knowledge and skills to students, but as a process in which the student actively constructs his own knowledge and is responsible for his own learning process. In this approach, learning can be seen as a process that takes place in a field of two dimensions: actors (students and teachers) at the one hand and the learning infrastructure (goals & content and materials & infrastructure) at the other hand (Plomp, ten Brummelhuis & Rapmund, 1996). Technology that is contributing to this approach is part of Itzkan's transition or transformation stage. Voogt and Odenthal (1997) performed an extensive literature review to entitle the two dimensions for the present study (see also Figure 1).

Research Design

Two research questions guided the study:
- What is the rationale behind and what are instructional characteristics of innovative use of technology in pre-service teacher education.
- To what extent innovative use technology in pre-service teacher education is sustained.

Based on information collected from the Internet, from journals on education and experts in the field eight cases of innovative use of technology in pre-service teacher education have been selected: four in the Netherlands (NL), three in the USA and one in Finland (FIN). From the conceptual framework, the emergent practices selected for this study fit into the transition or transformation stage of technology use. In the case studies the focus has been on innovative use of technology at the classroom level. The teacher and the students are the primary units of analysis. Each case has been visited on location by two researchers. Data have been collected from documents (school technology plan, learning materials), interviews (with school management, computer coordinator, teachers and students) and classroom observations. For the analysis of the data a template (Schreier, 1996, Van den Akker & Voogt, 1994),

the so called EP-profile has been designed. The inter-rater reliability (Cohen's Kappa) of the EP-profile was 0.81.

Results

The rationale for integrating technology in the pre-service teacher education curriculum has above all to do with new demands from society. Teacher education colleges expect that prospective teachers increasingly have to use technology in their teaching practice. Often this is combined with a felt need for a new approach to learning. The eight cases in this study represent three major directions of innovative use of technology in pre-service teacher education: multi- or hypermediacases, the design of technology based learning environments and teaching and learning in a tele-learning environment.

Multimedia Cases

Multi-media cases represent a range of sophisticated technology supported learning environments, which have in common that they present (isolated) real-world illustrations of teaching practices. Through the combination video segments, audio and textual commentary together with random access facilities and hyperlinks an open-ended student-centered learning environment is created (Ladewski, 1996).

'*Multimedia case as anchor for focused discussions*' (MM1) describes a teaching/learning context wherein a multimedia case is used during class. The instructor presents the video of one case to the class, thereafter students bring up subjects they want to discuss. From the perspective of clustered subjects the video is watched again by small groups of students.

'*Hypermedia cases*[1] *in investigation*' (MM2) describes the use of multimedia cases parallel to an internship program of the students. Starting in a classroom setting students are challenged to discuss their experiences with lesson planning with the planning showed in the video. In a next stage students learn to navigate on the cd-rom, followed by using the cd-rom for investigating own research questions. The cd-rom also contains presentation facilities, which makes it possible that students present the results of their research and illustrate it with hyperlinks to parts of the hypermedia case.

Designing Technology Based Learning Environments

It is the intention of this approach that pre-service students not only need to learn basic technology skills, but also must experience themselves how technology can be integrated in elementary and secondary schools. The teacher as designer is the basic philosophy behind this use of technology in education.

In '*The electronic consumer guide*' (DE1) students prepare a project for secondary school children. In the first phase the pre-service students prepare an example of an electronic consumer guide themselves. In this phase the students learn to use the technology. Based on their experience a guide with worksheets for secondary school children is prepared. In the third phase pre-service students coach the secondary school children in the execution of the project.

'*Art in the school*' (DE2) is a teaching/ learning context in which pre-service students build a virtual museum. The museum must be instructive and attractive for middle school students. The museum consists of five pieces of art. Each piece is discussed from seven perspectives. Students in pairs are responsible for the elaboration of such a perspective by using Adobe Photoshop. A group of fourteen students is responsible for the piece as a whole. In this way five teams are formed. In this approach technology skills are combined with applying theory on art review.

In '*Developing a learning environment with Hyperstudio*' (DE3) students design a constructivistic learning environment for elementary school students. A design model forces the pre-service students to reflect on the design process.

Tele-learning environments

[1] Compared with multi-media cases hyper media cases also have presentation facilities. We will use the term multimedia cases in this paper for both applications.

In this approach the traditional classroom is (partly) replaced by a virtual environment, which supports learning via electronic discussion platforms, video-conferencing and websites. The approach intends to increase flexibility in education.
In *'Science phenomena on the Internet'* (TE1) two pre-service students from different campuses investigate a science phenomenon. The result of their research is presented on a website. Also the communication with their partner, the whole group of students and the instructors takes place via this website, which has a discussion group, mail facilities, resources and possibilities for project planning and linking to the work of the other students.
In *'Interactive websites'* (TE2) students study the way people learn and understand. In the first part students become acquainted with theories on this topic, in the second part they apply the theories through creating lessons[2]. In this phase the instructor communicates with her students using e-mail. In this part of the course students assemble a digital portfolio. The instructor determines the structure of the digital portfolio. The students put the results of their work into the digital portfolio, which is then commented by the instructor.
In *'Collaborative learning via an electronic discussion platform'* (TE3) Finnish pre-service students communicate via a web-based discussion platform with American students about concrete teaching experiences. Students bring in examples, which are reflected from the perspective of theory, experiences of peer students and comments from the instructors.

Rationale and instructional characteristics

We will analyze these innovative examples of technology use in pre-service teacher education from the perspective of change in goals and content , shifts in roles of teachers and students and characteristics of materials/infrastructure. The overall result of the analysis is presented in Figure 1.

Change in goals and content

Much time is spent on learning skills instead of knowledge. In the design cases and the tele-learning cases much instruction time is used for learning to use the technology. besides technology skills time is spent to collaborative skills, problem-solving skills, meta-cognitive skills and research and information skills. Learning skills is embedded in an authentic context, such as realistic teaching practices in both multimedia cases and the preparation of lesson materials. There is not much attention yet for multidisciplinary approaches. In two tele-learning cases a digital portfolio and a website respectively is used for following the learning process and providing feedback to students. This can be considered as a first effort towards a new system of learner evaluation.

Shifts in roles

In all cases students are active learners. This is promoted by active instruction methods, often embedded in a learning environment created by the instructor. The main role of the instructor is to stimulate and structure discussion and reflection, sometimes in relation to students' research or to their products. Instructors often provide individual feedback to the students. In some cases students have to work together, but systematic coaching of this collaboration is only happening in one case. Often instructors share with their students the responsibility for the learning process with respect to planning. Rarely students are responsible for their own learning goals. Students often become experts for their peers on parts of the topic they are working on. Sometimes instructors become partners of the students where they jointly explore the possibilities of the software.

Materials and infrastructure

In nearly all cases a variety of technology is being used. The technology is user-oriented , used as tool for the design of products, the preparation of presentations, or the search for information. In only one case the technology stays in the hands of the instructor. In four cases the technology is the main component of the learning environment. In the other cases technology is a means of communication or

[2] The series of lessons must contain at least three lessons in which technology is used.

a tool in the design of a product. Study guides often contain not much more than general information about the course. Only in two cases they provide extra aids, such as a design model, or an on-line aid for using the technology and for making a project plan. Flexibility in time and place of learning is an issue in quite some cases.

Location	MM1	DE1	MM2	DE2	TE1	TE2	TE3	DE3
	USA	NL	USA	NL	NL	USA	FIN	NL
I. Goals and content								
A. link with real life	■	■	■	■		■	■	■
B. accentuation of skills	■	■	■	■	■	■	■	■
C. subjects are combined				■				
D. boundaries of subjects are crossed				■				
E. new methods of learner evaluation				■	■	■		■
II. Roles of instructors								
A. uses active methods	■	■	■	■	■	■	■	■
B. tunes to individual needs	■				■	■	■	■
C. structures the learning process	■		■			■	■	■
D. creates a learning environment		■	■	■	■	■	■	■
E. stimulates collaboration				■				
F. is a partner in the learning process		■			■		■	■
G. shares responsibility for progress		■	■	■	■	■	■	■
III. Roles of students								
A. is active	■	■	■	■	■	■	■	■
B. is independent		■	■	■	■	■	■	■
C. shares responsibility							■	■
D. is a team member		■		■	■			
E. becomes an 'expert'			■	■	■	■	■	■
IV. Materials and infrastructure								
A. user oriented technology	■	■	■	■	■	■	■	■
B. variation in technology use		■	■	■	■	■	■	
C. other non-structured resources are used		■		■	■	■	■	■
D. technology is the learning environment	■		■				■	■
E. study guides					■			■
F. individual and small group work places			■		■	■		■
G. flexibility in time			■		■	■	■	■
H. flexibility in location		■	■			■	■	■
I. multidisciplinary teams of teachers				■			■	
Total	**8**	**13**	**15**	**17**	**17**	**17**	**19**	**20**

Figure 1: Overview of instructional characteristics; score on the EP-profile.

Sustainability

Based on literature on implementation (Fullan, 1991) sustainability has been operationalized in two aspects: internal embedding (teacher's routines and commitment) and external embedding (clarity on embedding in the curriculum, the school organization and the environment). The cases on innovative examples of technology use in the study seem to indicate that innovative use of technology in pre-service teacher education still is in a developmental stage and not yet very sustained. Two cases had an experimental status and served only a very limited number of students. The others were carried out for the first time and part of major innovations going on at the teacher education institute. All innovative practices seem to be very dependent on the commitment of instructors and not yet on their routine. Also a clear embedding in the curriculum and in the broader school organization is still lacking for half of the cases.

Where Present and Future Collide

In this study expectations on teaching and learning in the 21st century as described in the literature are compared with some innovative examples of technology use in pre-service teacher education. Innovative use of technology in pre-service teacher education seem to become more and more an issue.

The study shows how pre-service teacher education colleges from several countries deal with this challenge and which problems they face. The teacher education colleges is this study, are in the front line of the developments. However, they still are in the beginning of a complex change process. We will summarize here some of the problems they encounter.

- In six of the innovative practices a new vision on teaching and learning emerged. However, this new vision did not always affect students' view on education. For instance the products designed by students seem to have a better match with traditional education than with an innovative view on education.
- The anticipated integration of subject matter knowledge and pedagogical content knowledge in the eight innovative practices is not yet well elaborated. For instance, the pedagogical design of the products is guided a lot by intuition of the students instead of their theoretical knowledge.
- Instructors are still looking for their role. Although they often use the term 'coach' or 'facilitator', they only give a very limited interpretation of these terms in teacher-student interactions.
- Students are modest in the learning effects they experience. In most of the practices they only mention technology related skills, while their instructors specify a variety of goals to be learned, such as problem solving, communication and meta-cognitive skills.
- Multidisciplinary is hardly an issue. The preparation of teachers is still not geared towards approaching problems from perspectives of several disciplines.
- The development of new ways of learner evaluation is a necessity. It is important to be able to evaluate the effect of the new approaches on learning. Otherwise the impact of innovative use of technology remains limited.

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Creating the Future: A New Skill Area for Preservice Education

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Abstract: The preservice education curriculum at the State University of West Georgia includes an examination of technologies which could transform our society. The College of Education faculty feel that being able to visualize the potential of these technologies for changing education as we know it as critical a skill to educators as using any of today's technologies. This article focuses on five types of technologies that are likely to have a profound, continuing influence on shaping practices in society and education. For each type, examples are given of current and projected applications in education that teachers should include in their vision for tomorrow's schools. These technologies include: voice-activated programs, electronic books, virtual environments, networking options, and wearable computers.

Introduction

Most current school reform proposals acknowledge that technology has a role to play in creating better education systems, but few look at technology in society the way it will be 10 years from now or are able to measure accurately the dimensions of its transforming potential. Dramatic changes to education precipitated by technology already have begun. The Internet brought about in a few years what technology had promised to do for the last forty: it brought computers into widespread demand in classrooms. Now technology developments on the horizon promise to change the definition of "classroom" itself. Educators must be prepared to meet these shifting definitions with practical and proactive strategies.

At the State University of West Georgia, we feel that predicting technologies which could transform our society and being able to visualize their potential for education is as critical a skill to educators as using any of today's technologies. Therefore, we include an intensive examination of this area as an integral component in all our teacher preparation programs.

The coverage of this topic changes each semester to keep our preservice and inservice teachers up-to-date on the latest developments in emerging technologies. However, it has become apparent that certain types of technologies are likely to have a profound, continuing influence on shaping the nature of teaching and learning and the way schools will be structured. Developments in these areas are covered each semester. This presentation will demonstrate five such technologies that are updated each semester in the ongoing emerging technologies components of our preservice program. Each will be summarized as to its the potential impact and current and projected applications in education that we should include in our vision for tomorrow's schools.

Why Create the Future?

As Peter Drucker said, "The best way to predict the future is to create it." Educators who are able to project which technology resources and applications could have greatest impact on society in general are better

prepared to create the kind of future they want, rather than to take the stance of reacting to conditions that suddenly confront them. Educators often find themselves in the uncomfortable position of reacting to calls for school reform and restructuring based on conditions that became apparent to society quite suddenly. Most reform movements have forced educators to react quickly with solutions to meet these new conditions and demands. Now, however, we in education have the opportunity to create a restructured education system based on what we can see will happen in the future–not only in terms of future needs but future resources that will be in place to meet them (Wiencke 1999).

Five Transforming Technologies

Technologies that have had greatest impact on education were developed for business, the military, and entertainment, rather than for education; this trend will continue to drive the evolution of learning environments. The "technology catalysts" emerging outside education that could move us quickly toward truly technology-integrated teaching and learning include:

1. Voice-activated programs
2. Networking options
3. Electronic books
4. Virtual environments
5. Wearable computers

Voice-activated Programs: Now Hear This

What Are They?

From portable to laptop to notebook to palmtop, computer manufacturers have continued the drive to create smaller and smaller system formats. As this trend continues, one obstacle remains to this goal: the system interface. The traditional keyboard interface is limited to a size that can be efficiently used by the human hand. Speech recognition is the solution that many companies are banking on to remove the necessity of using hands to use the computer. Speech recognition programs allow people to control the computer through voice commands and input text directly into programs, like word processing without keyboarding. The reverse of this is use of text-to-speech utilities which read text from the screen and convert the text to speech.

Potential Impact in Society?

Hands-free computer control and input will allow not only the production of small hand-held devices but also computer accessibility to the visually and motor impaired. Gone will be the days of requiring keyboarding as a prerequisite for computer literacy. Gone too, or at least drastically reduced, will be incidence of repetitive motion aliments. Although miniaturization of computer systems in itself will be a catalyst for many changes in education, it will be addresses in a later section on wearable computers.

Current and Projected Applications in Education

For educators, voice-activated programs could have a profound effect on how students interact with technology and with the entire learning process. Take for example the basic processes of reading and writing. If machines can do the reading and accurately take dictation, will the necessity to learn how to read and write remain? Such a dramatic shift would hardly take place over night, and would be years in the future, if at all. However, the fact remains that as technology changes so will society and society's education needs. If the primary interface to the system becomes the microphone and not the keyboard, students will begin dictating their assignments. Voice synthesizers could read their stories back. The entire process would change along with the

skills needed to interact with the system. It is certain that additional skills in speaking and listening will be required.

Distance Options: Angels in the Atmosphere

What Are They?

Distance learning has become education's new "hot property." The ability to link students to educational resources and courses and each other without regard to time or place is beginning to have a noticeable impact on the traditional delivery system. Currently, broadcast-type distance courses that offer instruction that is most comparable to face-to-face courses are limited either to specialized "satellite" centers which provide real-time interactive voice and video connections or closed-loop (e. g., compressed video) systems that can provide this capability. However, advances in distance networking, high speed Internet connections, and broadcasting options promise to make more and better high quality distance learning options available.

One such development is Angel Technologies™ (1998) use of high-altitude airplanes that can replace satellites to receive and send signals. These aircraft circle a metropolitan area continuously transmitting signals in a given area until they run low on fuel. Then they are replaced by other aircraft. Naturally, there are some logistical problems involved with this activity (e. g., weather interference, other aircraft in the region), but the idea is only one innovative alternative to providing an essential service to improve the quality of distance learning.

Potential Impact in Society?

With improved broadcast capabilities, distance learning options of this kind will become more cost effective, and affordable distance learning will no longer be limited to web pages or special training sites. High speed access will allow the same instructional capabilities at home or at school.

Current and Projected Applications in Education

When DL formats can emulate more closely the degree of interaction of a face-to-face classroom, they will become more attractive to a greater cross-section of society. It may become more feasible and lucrative for profit-making companies to begin offering courses or programs. If this happens, the number of resources from which parents and students can choose will increase, creating a kind of educational smorgasbord. The emphasis may change from home schooling to schooling at home. As Wiencke (1999) says in an upcoming book on integrating technology into the classroom, "Advancements in networking will make it more feasible for students to take advantage of the goal-based scenario learning described by Schank and Lass (1996), the "collaboratory notebook" ideas offered by Edelson, Pea, and Gomez (1996), and the student communities hypothesized by Scardamalia and Bereiter (1996)".

Electronic Books: Library to Go

What Are They?

Electronic books are flat displays that are similar to those on laptop computers, but which can be held in your hands like a book. Softbook's Softbook® and NuvoMedia's Rocket eBook® (Read 'em and beep 1998) are two brands currently available, but the concept is so marketable that more probably will be appearing on the market in the near future. Current systems are can download full text documents and books to the system. Utilities include the ability to search, annotate, highlight, bookmark, and link reference material.

Potential Impact in Society?

The greatest impact will be on the printing industry. Since users will be able to carry multiple publications (e.g., 4,000 pages) in one book-size device, paper-print books should become much less in demand. If this technology takes hold as it promises to, bookstores could become totally online. Costs of publications should come down, as overhead becomes lower.

Current and Projected Applications in Education?

Titles for these new "books" are just beginning to be marketed and are primarily in the popular press rather than for education. However, if and when textbooks become available in this new format, they could quickly become very attractive items. Students will no longer will weighed down by heavy backpacks; instead, they are able to carry all of their books in one lightweight, portable "container." Also, since they will be able to annotate text and add "bookmarks" to various locations in the text, these books should be a great help to students as they study and do research. Campus bookstores could download books instead of stocking them. We could see a great influence on educational publishers. Lower production costs may mean that educational materials could be much less expensive, making access to high quality educational resources more affordable and, therefore, available on a more equitable basis to a greater number of students.

Virtual Environments: Seeing is Believing–and Learning

What Are They?

Virtual Reality (VR) environments range from on-screen 2D visualization to full emersion 3D systems (including Cave Activated Virtual Environments or CAVEs) to simulate real or imaginary objects or places. The 3D virtual reality systems include head mounted displays, voice interaction, and tactile gloves (Ozer, 1998). CAVEs are 10' x 10' rooms made up of 360° screens (Cruz-Neira, Czernuszenko, & Pape 1997. Images of a location, e.g., a cityscape, are projected onto the screens from behind so that it appears to viewers they are actually in that location. Other VR environments offer avatars, or images that represent people in cyberspace.

Potential Impact in Society?

All these environments make possible an unlimited number of simulated experiences. Although they are now used primarily for entertainment, these systems promise to play increasingly greater roles in interactive simulations for education, training, and research. Many people are familiar with VR use in flight and drivers training. Also, it also is used in manufacturing prototyping where, for example, car designers can see how a car design would work before they build it. More recently, VR training has come into use in more sensitive areas such as medical training, offering future surgeons opportunities to practice their skills on less fragile "subjects."

Current and Projected Applications in Education

Although costs are prohibitive at this time, future applications in education could increasingly realistic inside-the-system simulations in science (e. g., exploring the inside of a cell). Many educators look forward to the time when students can use these 3D environments to take virtual field trips to locations around the world and participate in historical reenactments, perhaps using their "historical avatars" or in CAVEs.

Wearable Computers: You CAN Take it With You

What Are They?

Wearable computers are whole computer systems which the user can wear on clothing or their bodies and carry around while working with them. Interfaces include voice recognition, head mounted displays, and pen tablets. Data transfer between portable units can done through touch, infrared, or direct connection. Network links by phone line and cellular modem connections provide additional access to larger systems. Current applications are primarily in industry, public works, transportation, utilities, medical teams, and the military.

Potential Impact in Society?

Continual non-obtrusive computer access will take portable computing to the next level, similar to the way cellular phones have changed communications. Combined with wireless communications, voice-activated resources will make it possible for people to use the Internet and e-mail wherever they are. In addition, these computers would be able to interface with other specialized systems that are beginning to be installed, for example, in automobiles.

Current and Projected Applications in Education

Wearable computers will allow students to access the Internet and e-mail, and the educational resources they represent, anytime or anywhere (in the classroom, on field trips, during lunch!) Schools could take attendance automatically and quickly; they will be able to locate students through their wearable devices (Bott 1998). Parents and teachers will be able to locate and communicate with any given student at any time. These devices have implications for students' safety. In combination with Geographic Positioning Systems (GPS), it will be possible to track and locate the exact position of anyone wearing a linked device.

Conclusion: The Shape of Things to Come

Many of the technologies described here will be used in combination with each other. For example, wearable computers will use voice recognition technologies and will make it easier to participate in distance learning and virtual environments. Though they may seem like far-fetched science fiction now, these developments are emerging very quickly and could be operational enough to make a major impact in the near future (e. g., the next few years).

Clearly, the next decade could see fundamental changes in the way schools are structured and students participate in learning activities. New curriculum must be visualized and developed to take advantage of these powerful capabilities. We must decide what "the place called school" should look like and what goals it should achieve. If educators and schools, rather than others like business and industry, are to make the decisions that will shape the impact of these and other technologies on teaching and learning, each preservice educator must become aware of and stay up-to-date on these new and powerful resources. They must learn to adopt effective strategies (e. g., reading technical and educational publications, attending training; perusing Internet websites) for keeping as current as possible on the new and anticipated technologies described here, as well as methods of using them (Wiencke 1999).

If technology is to make a real difference in their work, teachers must be able to visualize what they are working toward and recognize the kind of infrastructure necessary to bring about what they see as necessary; they must become active in building what is needed for change and growth. This new technology skill area–developing a personal vision for the kind of education system technology could help create–could become the most critical one for all teachers to acquire.

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Incorporating Web-Based CMC in the Methods and the Practicum Courses of Preservice Teachers

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Abstract: CMC has started its influence of the teacher education programs in Taiwan. In this paper, we present the implementation of a web-based CMC system in our computer teacher education program. Thirty-four students enrolled in the Teaching Methods and Teaching Practicum courses were encouraged to use the system throughout the school year. Experienced high school teachers were asked to lead the discussions with the students in the CMC system. Survey results indicate that the web-based CMC system is an effective tool for facilitating preservice teachers' training, but the moderation skills of the experienced teachers need to be further improved.

Introduction

With the advent of computers and telecommunication technology, CMC has shown its impacts on the ways we train teachers in the recent years. Teacher educators have been incorporating a variety of CMC software tools in traditional teacher educational courses. For examples, Poole and Simonson (1995) and Poole (1996) used e-mail as a link between preservice teachers and the elementary students in a Mathematics Teaching Method course to provide constructivism activities for the preservice teachers. Johnson (1997) used electronic mailing list to build a partnership between preservice teachers and their mentor teachers in a Reading Method course. Francis-Pelton and Pelton (1998) managed a Teaching Mathematics Using Technology course through WWW, Usenet, and E-mail to facilitate the access of resources and the communications between students. Lucking and Childress (1998) experimented a teleconferencing system in an Educational Technology course.

In the past, the authors have experimented in using text-based electronic bulletin board system (BBS) to promote reflective thinking among preservice teachers in a teaching practicum course (Wu & Lee, 1998). With the aid of BBS, the preservice teachers had more opportunities to interact with each other and to share experiences and problems, and to provide timely emotional support to others when one faced difficulties during the field teaching period. However, it was also found that some preservice teachers did not actively participate in the discussions and there were calls for the experienced teachers to participate in the discussions. The text-based BBS CMC system, inherently limited to text only, did not take full advantage of today's computer technology by offering multimedia contents. With WWW, multimedia contents can be easily obtained and viewed. Thus, web-based CMC system can offer more interesting contents by integrating text, pictures, sound, animations, and videos into the resources provided.

In this study, we used a web-based CMC system, namely Student Teacher Network (STNet) [Chiou, 1998], to facilitate the instruction in both the *Teaching Methods* and the *Teaching Practicum* courses. The Teaching Practicum and Teaching Methods courses are two of the 13 pedagogical courses (30 credits in total) required for secondary teacher certification at National Taiwan Normal University. Both are yearlong courses and are usually taken during the students' senior year at the University. The Teaching Methods course emphasizes instructional design and teaching strategies. Course activities include assigned theory paper readings, group discussions, and journal writings. The Teaching Practicum course concentrates on micro-teaching in the first semester and field-teaching in the second semester. The two courses are organized together to provide students opportunities for experiencing theories to practice. Students who enrolled in the two courses were asked to access the course materials and to attend the discussion forum in the web-based CMC system.

Implementations

The benefits of using CMC in preservice teacher education can be summarized as: (1) extending and enriching the traditional course environment, (2) extending and enriching communication during student teaching, and (3) building new partnerships between preservice teachers, inservice teachers, or their prospective pupils (Collis, 1995; Van Gorp, 1998). The STNet CMC system was designed to achieve the above goals with three features. The *Instructional Resources* feature provides materials that support the activities of both courses. The *Discussion Forum* feature serves as a place for students to post their journals and to discuss issues raised during field teaching. In addition, *experienced teachers* were asked to log onto the system regularly and to provide helpful comments in the discussions.

Instructional Resources

With STNet, we were able to place multimedia instructional resources in the system for students' reference. These include, for examples, the papers discussed in class, examples of lesson plans, case studies of class management, CAI and simulation software, latest software and hardware news, resource links (e.g. bookstores, computer stores, etc.), and the curriculum guidelines. A full-text search engine was also provided for easy retrieval of the needed information. Many classroom activities would require the students to make use of the resources available in the system. For example, when discussing secondary computer curriculum in the Teaching Methods class, students were required to review the curriculum guideline and the related papers available in the system before the class.

Discussion Forum

The discussion forum provides a venue for off-classroom interactions among the students. For the Teaching Methods class, students were required to contribute at least one article continuing the activity started in classroom. For example, if the in-class discussion was centered on usage of analogy in explaining abstract terms, then the students may post analogies that could be used when teaching, say the concept of "recursion." This was especially important during the field-teaching period when the students and the instructors of the courses do not see each other very often. Also, it allowed experienced teachers to join students' discussions and to provide timely advice. The use of the web interface and the database allows postings of graphics, pictures, and other multimedia materials. Furthermore, the discussions in the forum can be searched and displayed either by authors or by dates.

Experienced Teachers

Five experienced teachers, all from different schools, were asked to be moderators of the discussion forums and to lead the discussions. Being experienced teachers, they can provide the students with better and more realistic pictures of the teaching environment that they are likely to encounter in the future. Each of the experienced teachers was to initiate topics for discussions and to lead the discussions in a forum. However, all were free to join in on the discussions in the other forums.

Issues and Feedback

Questionnaires were completed at the end of the school year to gather feedback from the 34 students who enrolled in the two courses and have participated in the CMC activities. The following is a summary result of the questionnaire.

System Functionality

It was found that the majorities of the students were willing to use the system. Despite having been required to attend the discussion forum only once a week, some have logged onto the system everyday, while majority has logged on several times a week. Table 1 is a summary of the survey on the benefits of the CMC system as viewed by the students in the courses. Almost all the students agreed that the web-based system was helpful in supporting the courses (item 11, 97%). All of them valued the opportunities to see how others reacts to different classroom

situations raised in the discussion forums (item 4, 100%) and most of them were willing to share with others their field teaching experiences (item 6, 88%). In addition, about three-fourth of the students agreed that the system offered good instructional resources (item 1, 75%) and was useful in improving their teaching skills (item 3, 72%). This was an indication that the system fulfilled the goal of providing an environment for learning and for sharing experiences. However, the system was not perceived by most of the students to be a good tool for receiving timely encouragement and emotional support (item 7, 38%). Merely having discussions in the forum was not enough to validate theory learned in class (item 10, 44%).

Table 1: Percentage of the students who agreed on the benefits provided by the CMC system

Items	Percentage (%)
1.Obtaining instructional materials and teaching strategies	75
2.Clarifying one's belief about teaching	50
3.Improving one's teaching skills	72
4.Understanding the viewpoints of others	100
5.Knowing what's going on among all the classmates	53
6.Sharing personal experiences with others	88
7.Affording encouragement and emotional support	38
8.Getting advice from the experienced teachers	56
9.Resolving problems encountered during field teaching	69
10.Validating theory to practice	44
11.Overall, the CMC system is helpful to me.	97

Role of the Experienced Teachers

Table 2 is the summary result of the survey on the usefulness of having experienced teachers moderating the discussion forums. Most of the students were satisfied with how the discussions were led by the experienced teachers (item 2, 78%) and the comments provided by the experienced teachers (item 4, 72%). However, only some of the students felt that they received adequate emotional support (item 3, 31%) and timely answers on instructional situations from the experienced teachers (item 6, 41%). Upon examination of the dialogues between the students and the experienced teachers, it might be that the moderation skills of the experienced teachers needed to be improved.

Suggestions for Improving Participation

Table 3 is the summary of the survey on ways to improve students' voluntary usage of the CMC system. From the survey, there are three directions of future improvements: the resources available on the system need to be increased (item 7); the user interface needs to be reworked so that fewer mouse clicks (choices) are needed before getting to the resource desired (item 1); and participation of the experienced teachers need to be improved, both in terms of the appearances on the system and their skills in initiating more interesting topics for discussions (items 2 and 7).

Table 2: Percentage of the students who perceived the presence of the experienced teachers in the discussion forum as being helpful

Experienced teachers is useful in	Percentage(%)
1.Initiating discussion topics	56
2.Leading discussion	78
3.Providing timely encouragement and emotional support	31
4.Providing timely responses and comments	72
5.Giving advice on pedagogical issues	50
6.Answering the posted problems	41

Table 3: Ways to increase participation in the CMC system

Items	Percentage(%)
1.Improving the user-interface of the system	81
2.Increasing the participation of the experienced teachers	69
3.Improving the experienced teachers' moderating skills	50
4.Inviting the subject experts to join in on the discussions	38
5.Providing more instructional resources	84
6.Having the course instructors to join in on the discussions	50
7.Initiating more interesting topics for discussions	81
8.Giving suitable rewards for active participants	9
9. Others	9

Conclusions

All of the students in this study have been using the BBS system for more than three years prior to the Teaching Method and Teaching Practicum courses. When asked about utilizing discussion forum on a BBS system and the current web-based system, three-fourth of the preservice teachers preferred the BBS system. Two major reasons raised are that BBS is faster (since it is text-based), and that they are more familiar with BBS's user interface. These indicate that although web-based interface allowed multimedia contents and more features, the accessing speed of a web-based CMC system should be a concern in future implementations. In addition, familiarity with the CMC system also plays a role in whether it can be successfully integrated into these courses. Some students also requested for a real time synchronous discussion function, much like the "chat room" function in a BBS system. Furthermore, some wanted to see more teaching resources and more thought provoking topics in the discussion forums. It was felt that these improvements should stir up more interests in students joining the CMC activities.

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Standards Based Technology Competencies: Electronic Portfolios In Pre-Service Education

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Abstract: The College of Education at Idaho State University has a new standards based program established upon a clear conceptual framework in which standards in technology comprise a set of principles stated in terms of what professional educators should know and be able to do as a result of their professional education program. Student begin the process by developing lesson plans and support material like handouts, tests, etc. These lesson plans provide the backbone upon which each of eight other key technology components are placed and sequenced. The process of developing electronic portfolios is critical in helping students integrate these new standards and represent concrete outcomes that demonstrate how students meet or exceed ISTE based competencies for integrating technology into the classroom. The final electronic portfolio is constructed to be cross platform compatible and accessible over the Internet. The final integrated portfolio is reviewed and approved by a state board certified assessment team.

At Idaho State University the College of Education has implemented major programmatic changes. The pre-service teacher education program has undergone substantive changes in its course offerings, and integrated course material in new ways using both content knowledge and pedagogical principles and practices.

This new standards based program was established upon a clear conceptual framework in which the standards comprise a set of principles stated in terms of what professional educators should know, and be able to do as a result of their professional education program (Salzman et al 1998). There is a strong belief that ". . .the Learning-Teaching Processes sustain our Student-Centered Professional Development Model through which novices progress to professionals as they acquire more focused repertoires of practices incorporating the knowledge, dispositions, and skills cited in the standards. Within our professional development model, students engage in a continual cycle of do-reflect-modify-evaluate," and "Assessment provides students with multiple opportunities to develop their

learning and receive feedback regarding their professional practice so that both they and we can gradually discern the level to which they have integrated the standards." (Salzman et al 1998)

In practice, as of Fall 1999, the college will require all students graduating from the program to have completed a general education portfolio. This portfolio is based on twelve core standards for beginning teachers. These standards are:

Standard 1:	Subject Matter Knowledge The teacher understands the central concepts and processes of inquiry of the subject matter he or she teaches and creates learning experiences that make subject matter meaningful to students.
Standard 2:	Professional Studies and Research The teacher uses alternative theoretical perspectives and research to guide instructional decision-making and reflection on practice.
Standard 3:	Student Individual Differences The teacher uses knowledge about student individual differences to plan, deliver, and analyze instruction.
Standard 4:	Planning for Instruction The teacher plans meaningful£l learning experiences that promote student achievement and active engagement in learning.
Standard 5:	Instructional Delivery The teacher uses a variety of instructional strategies to promote student achievement and active engagement in learning.
Standard 6:	Assessment The teacher uses a variety of formal and informal assessments to evaluate learning and teaching.
Standard 7	Management of the Learning Environment The teacher creates and maintains a safe and effective learning environment.
Standard 8:	Technology The teacher uses technology in the planning, delivery, analysis, and assessment of learning and instruction.
Standard 9:	Literacy Communication The teacher supports and expands student literacy skills and models effective communication.
Standard 10:	School-to-Work Transition The teacher understands the central philosophical principles and processes of the school-to-work concept and creates learning experiences that enable student career awareness, exploration, and decision making.
Standard 11:	Family, School, and Community Interrelationships and Resources The teacher fosters relationships with the family, school, and community to support student learning and well-being.
Standard 12:	Personal Characteristics and Interpersonal Skills The teacher displays beliefs, values, and behaviors that guide the ethical dimensions of professional practice.

While each standard contributes to the integrated whole the technology strand or Standard 8 is based upon International Society for Technology in Education (ISTE) standards and is consistent with the Idaho State Board of

Education's mandate that all educators within the state be certified in their ability to adapt and integrate technology into the educational environment.

Portfolio's are one natural experientially based tool or medium that allow students to record experiences, events, and changes associated with their learning. Thus a given portfolio has a set of entries that are representative of key concepts, experiences, and changes undergone while in the undergraduate education program. Because of the "do-reflect-modify-evaluate" features of the program, all students are required to develop porfolios that reflect work in core content areas and course work in the College of Education proper.

Electronic portfolios are similar in process and function to paper portfolios. However, by using an electronic format students are able more easily to revise, adapt, and substantively change their portfolio content as they progress through the program. The process of revision is always daunting. However, the electronic medium allows the user to easily adapt new material or revise older material. Substantive revisions involve reflection on course content, creative reordering of the possibilities, additional insights gained as the student matures in the program, via ongoing formative assessments that lead the student to a deeper and more holistic understanding of their educational experience. Thus they provide multiple opportunities for the student to reflect on, refine, and integrate, in a concrete way, what they have learned into a more meaningful and practical whole.

Porfolios and technology have received much thoughtful attention focused on how they can best serve to enhance student's pedagogical skills. Fortunately, an infusion of resources provided by the Idaho State Board of Education, help create a computer lab in the College of Education (Yates et al 1997). This Student Technology-based Electronic Portfolio (STEP) lab, has a full complement of MAC and PC software and hardware, and fully functional MAC and PC multimedia instructional platforms. These platforms allow faculty to model various uses of technology, using either computing environment, and a place where students can practice presentation skills using technology as an instructional medium.

This lab also provides a powerful resource base for our new Instructional Technology class. This new course focuses on students developing portfolio entries using word processing, database, spreadsheet, presentation, communication, and instructional software that center around a lesson plan that integrates technology into instruction. These entries are constructed to insure that they are consistent with the state requirements that all educators must meet to be certified as Idaho educators.

Education students learn to:

1. apply fair use guidelines associated with educational use of proprietary material.
2. develop a grade book program using a spreadsheet (Excel). This provides a basis for teaching students how to pose and answer what-if questions.
3. use presentation software (e.g. PowerPoint). Good presentation techniques are also emphasized and the presentations developed are linked directly to their core lesson developed earlier in the course.
4. adapt telecommunications concepts. The students are taught to use the Internet as both a professional and instructional resource.
5. develop a Web page. This reinforces their ability to work on the Internet as a presentation medium and it develops the important skills necessary to refine and place their electronic portfolio on the Web.
6. use a database to model and develop higher order thinking skills. Students are taught how to use inductive and deductive thinking processes in their decision making.
7. use a range of educational software. This helps teach students to integrate software into the curriculum.
8. use assistive technologies to insure that students with special needs are given a quality education.
9. integrate student work samples that they have acquired from students they have taught at various times during their program at the COE.

By the integration of technology into the educational pre-service program, our graduates meet or exceed the ISTE-based standards for technology use by practicing educators.

In summary, change is a natural part of the world and knowing that graduates from the program are well grounded in instructional technology is reassuring and will contribute positively to the continued growth of the educator as they enter service. Learning to use porfolios as a teaching and learning tool extends naturally into the students in-service

experiences, and gives them the learning tools to refine their use of instructional technology. This ultimately maximize the opportunities for their students to develop similar strategies and skills that enhance their learning.

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Reading, Language Arts & Literacy

Reconceptualising Literacy In The Information Age

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Abstract: The advent of Information and Communications Technology (ICT) requires us to reformulate our definitions of literacy. To conventional 'schooled' literacy, the simple ability to read and write, we need to add the concepts of 'networked' and 'extended' literacy. The development of these, especially the latter, requires a new approach to the learning and teaching process. This can best be observed at the present time in experimental ('laboratory') contexts, such as those presented by technology enriched classrooms, which are currently being studied in the authors' ITEC project. The paper considers the need to reconceptualise literacy in order to develop collaborative pedagogical and learning styles needed for an education suited to the 21st century.

Introduction

Information Technology stands in an interesting relation to literacy in that it is capable of supporting and promoting the basic skills of reading and writing - the dominant classroom definition of literacy (Papert, 1993) - and also carries with it the inevitability of extending that definition into a model of literacy which acknowledges that it is to be a dynamic concept extending beyond the basic acquisition of reading and writing skills. There has been in current thinking in England and Wales a significant shift in terminology from Information Technology (IT) to Information and Communications Technology (ICT), a term first used in the Stevenson Report (DfEE, 1997), the report of a committee set up to advise the incoming Labour government (May, 1997) on the role the new technologies should play in the curriculum. The addition of the word 'communications' emphasises the extent to which new models of literacy need to be developed beyond the limited one of basic skills so that the acquisition and development of extended literacy skills requires a new taxonomy derived from the direct linking of IT with the processes of communication.

Paradoxically, in current UK thinking and practice there is a conceptual gap between the intentions underlying the newly established National Grid for Learning, clearly aware, as its name indicates, of the implications of Information Technology, and the much more limited definition which may be seen in the National Literacy Project which began in September 1998.

The former, rightly, speaks of:

> "..a definition of networked literacy [as] the capacity to use electronic networks to access resources, to create resources, and to communicate with others. These estimates of network literacy can be seen as extensions of the traditional skills of reading [and] writing...This is of central importance and provide[s] a link with the Government's focus on improving standards of literacy..."

The latter is conceived, however, in much narrower terms:

> "[It] unites the important skills of reading and writing. It also involves speaking and listening which, although they are not identified separately in the Framework [for the National Literacy

Project] are an essential part of it. Good oral work...is an important part of the process through which pupils read and compose texts" (DfEE, 1998).

Definitions of Literacy

We need to distinguish in thinking about literacy development in the Information Age amongst three levels, which we call 'schooled literacy'(following Margaret Meek, 1991), 'networked literacy', and 'extended literacy', in all of which Information Technology has potentially a part to play. It is important to see these three forms of literacy as a continuum, not a hierarchy, since it is our contention that any form of literacy can be experienced at any stage of a child's development. Here, it will be observed, we lean more towards Bruner's model of learning and the concept of 'the spiral curriculum' than to the 'stage-based' models derived from Piaget and his followers.

By 'schooled literacy' we mean the traditional role of the school in the teaching of reading and writing, supported (as suggested above) by a belated recognition of the importance of oracy, which is often, mistakenly, assumed to have been achieved when students are able to decode and create texts. Here, from the earliest years, ICT should have a significant part to play with, for example, the use of 'talking books' alongside conventional printed texts. This is found, however, all too little in most classrooms despite reported research that shows gains in both the understanding and construction of texts through early contact with multi-media materials (Adam & Wild, 1997). The rapid explosion of high-quality children's picture books in the 1970s and beyond has been of considerable importance here providing, for example, a foundation in early literacy experience for the later enjoyment of graphic novels and the understanding of information and interpretative resources such as those provided by CD-ROM. Indeed, this is where traditional definitions of literacy, as seen in the National Literacy project, begin to break down. Instead we would urge the merits of the expanded definition given in a recent position paper on literacy from the National Association for the Teaching of English: "For the purposes of this paper we take the term "text" to mean whatever is to be "read". A text [from the Latin *textus* (tissue), *texere* (weave)] is made by weaving together a combination of signs and symbols in designs intended to make meaning" (NATE, 1998).

Thus 'schooled literacy', traditionally seeing the acquisition of the ability to construct and interpret text, itself seen as linear and fixed, as an individual activity, though necessary, is no longer sufficient. Students in today's schools need to develop the concept of 'networked literacy' by which we understand the production and interpretation of many-layered texts, often created by multiple-authorship and interpreted by a number of readers working in collaboration with each other. This model of literacy is far closer to that now required by school leavers in the millenium years' world of work where, for example, writing is rarely undertaken as an individual task and equally text is constantly subject to changes and revisions, not simply as a matter of style, but in order to accommodate the rapid shifts in information being made available. The Internet has clearly shown how much modern text is unstable and shifting with Web sites undergoing constant updating and needing to be frequently 'revisited', a far cry from the traditional book between 'hard covers'.

Finally, by 'extended literacy' we understand the potential of classrooms of the future to extend beyond the boundaries of time and place so that students in different parts of the world can collaborate together in the construction and exploration of texts. Such collaboration will be made possible through the use of the Internet and the 'weaving' of hypertexts is likely to be the most dominant form of text creation and interpretation that will result.

Papert (1993) helpfully offers one redefinition of literacy. His view is that "becoming literate means thinking differently than one did previously, seeing the world differently". His contention is that traditional ('schooled') literacy is better defined as *letteracy*, which, in his terms, can be achieved independently of the acquisition of literacy. Literacy is the broader canvas for which ICT is the medium of access and construction.

The ITEC Project

We have recently been made aware of the potential for this extended view of literacy through our observation and research in classrooms as part of the International Technology Enriched Classrooms (ITEC) Project. This project seeks to explore through curriculum development work in classrooms and through associated research in Higher Education Institutions (HEIs) the conditions needed for learning and teaching in the technology enriched environment of the 21st century. Its focus is the establishment of a number of classrooms which can be used as laboratory situations in which ICT and the use of Multi-Media are used to enhance the learning and teaching context. It is intended to export the lessons learned from such classrooms to classrooms which are, as yet, less technologically well endowed.

Essentially the ITEC project seeks to provide links across the barriers of time and space, bringing students and teachers across the globe into contact with each other through the Internet so that peer learning can be encouraged and implemented. It enables teachers to explore and share different pedagogical styles and to explore how these can be melded to the different learning styles of students, who are involved in peer exchanges and peer learning.

Such work involves a fundamental reconstruction of traditional modes of pedagogy. It shifts the balance from teaching to learning and implies a range of learning styles including a good deal of learning from one's peers. This applies as much to the adults in the classroom as to the students. Indeed the distinction between the two may now be essentially a historical one. The classroom of the future will be 'a community of learners', not unlike Graves' (1983) 'community of writers', in which each participant is valued for what he or she can contribute rather than be accepted simply because of his or her place in a hierarchy of age or position.

In our work in such classrooms we are seeking to identify what students at different ages and in different contexts themselves define as 'literacy', how they conceive of the processes of reading and writing, or, perhaps more accurately, 'crafting', for the read text is as much one crafted through interpretation as the written one. In a recent article (Adams and Brindley, 1998) we demonstrated how one student was quite capable of expanding his revision of his text well beyond that of the mere revision of surface features which is what all too often passes for redrafting in the conventional classroom environment. It remains the case that both teachers and students need to be taught how to use ICT in this way. Snyder (1994) reports in her study of six Australian classrooms that "Each of the teachers emphasised the importance of correctness in writing and the publishing capabilities of the technology so that it was used primarily for transcription and the printing of 'a good copy'....None explored how the technology could be used effectively as an integral part of computer-mediated writing pedagogy. The focus in all six classrooms was on operationalising the technology, not on exploring its capacities to develop students' writing."

By contrast, in one ITEC classroom observed in South Grenville in Ontario, Canada, in 1997 and 1998, there was an entirely ICT based curriculum constructed around an industry model of projects and tasks. The work was undertaken in connection with communities beyond the classroom, involving, for example, published authors' feed-back on students' fiction writing. Writing was found to be purposeful and a keen awareness of audience needs was recognised in the production of accurate spelling and a grammatically correct text. Writing was often undertaken collaboratively and good oracy skills became an integral part of the writing process.

That letteracy and literacy can develop together is perhaps best illustrated by one event in the classroom. During the research we observed one pupil, who had been functionally illiterate on his entry to the class, when we first encountered him, a year later, was sitting in front of a computer reading (the book) *Anne of Green Gables.* He said that he wanted to know what everyone else was doing on the computers so thought that he had "better learn to read so as to find out what was on that little screen that got everyone else so fired up".

In a cognate way, another class, in Western Australia, has established a Fiction Factory where they invite other students from all over the world to participate with them in the construction of texts.

We have based our work in the investigation of 'classrooms of the future' rather than 'schools of the future' since very soon, schools, as we have traditionally known them, may have ceased to exist to be replaced by 'virtual classrooms' freed from the limitations of time and space.

Classrooms of the Future

This is very much what is happening already outside schools, in the workplace and elsewhere, with collaboration becoming more and more commonplace, whilst inside schools and higher education institutions, individual authorship and personal ownership of text still remains the dominant model, drawing, as it does, on nineteenth century conceptions of writing and publishing in the age of print technology. Yet much current academic thinking in English departments in the very same institutions about the nature of text and inter-textuality challenges such a conception at the most fundamental level, seeing text as collaborative and dynamic, with the gap between reader and writer being fundamentally broken down (Lanham, 1993; Kress, 1995; Tweddle *et. al.*, 1997). The inter-activity and the blend of text and graphics in a good web site is an excellent example of the new kind of text which is emerging, an important communicative and art form which must form part of the concern of literacy studies in classrooms at all levels in the future.

Part of the reason for our failure to have taken this on board in many of our classrooms of the present is the inadequacy in our thinking caused by our failure to have developed so far a metalanguage with which to talk about the new technologies. There is nothing new in this. Every new technological development has been discussed initially in metaphors drawn from the technology of the past. The incipient power of the internal combustion engine was talked about in terms of 'horse power', locked into an age when trams and carriages were hauled by horses;

similarly we talk of word processing in terms of metaphors drawn from print technology ('font' and 'point size' for example) The very use of such language, including the dominant metaphors of manufacturers such as Microsoft and Apple (windows, wallpaper, desktop, folders, waste paper basket) lock us *imaginatively* into the past and conceal from us the *technologically* innovative nature of the new medium with which we are moving rapidly into the future.

There are however some current developments that are beginning to capitalise on this future. 'Future classrooms', such as those described in the ITEC project, are beginning to be developed in several different countries. The present authors, between them, are in touch with innovative work in both 'networked' and 'extended' literacy in Australia, Canada, England and the Republic of South Africa. The latter is especially interesting, moving as it is, in many parts of the Black community, from a pre-print to a post-print (hypertextual) culture without passing through the intervening stage of print.

It is interesting to consider here the implications of a statement made by Professor Douglas Young of the University of Cape Town, now incorporated into the South African government's policy statement on language:

> "..[the concept of] literacies has to be expanded to include several different types of literacies. 'Literacies' stresses the issue of access to the world and to knowledge through development of multiple capacities within us all to make sense of our worlds through whatever means we have, not only texts and books".

The reconceptualisation of literacy in terms of the Information Age is essential if we recognise that learning to "access... the world and...knowledge" is critical to our present and future society.

Access and Availability

A real issue here is that of access and important work is being done in, for example, Australia to bring ICT potential to aboriginal communities and other "regional and remote areas" by using secure ICT 'telecottages' with the computers and other equipment powered by generators (details of this can be found on the Internet at the Imago site: http://www.imago.com.au).

In a paper written to explain the Imago *Modular Interactive Telecommunications Environment* (MITE) Project (March 1998), which details their plans for telecottages, Bill McGinnis (mcginnis@imago.com.au), quoting from a 1993 Telecom 2000 study paper for Telstra [the Australian national telephone and telecommunications system] by Tony Newstead, signals a number of "pragmatic factors often omitted when introducing new telecommunications technologies". These were:

- usefulness
- cost-effectiveness
- suitability to social, cultural and organisational sensitivities, and
- psychological suitability

It is claimed that "the MITE needs analysis model systematically addresses all of these factors plus other relevant considerations *in a community-focused process*" (our emphasis).

From the point of view of this paper, the third point is particularly important. As the Internet shrinks the world, it becomes ever more important to be sensitive to the different social and cultural contexts of its users. Much damage can be done if the fact that 80 per cent of the information on the Internet is in English leads to a greater cultural hegemony of English as the language of a particular cultural or racial group. It is salutary for those of us who are native users of the English language to recognise that monolingualism is the exception rather than the norm; the majority of the world's language users are at least trilingual and the English that is beginning to emerge as the *lingua franca* of the Internet is rapidly developing into a variety of English in its own right, a further example of English for Special Purposes (ESP). Some of the implications of this are discussed in Tulasiewicz and Adams (1998) and in several chapters in Stefik (1997).

Conclusion

The advent of technologically enriched classrooms across the globe makes possible a new model of education: teachers communicating with other teachers as peers in exploring differences and similarities in pedagogical style; students collaborating with students as peers in exchanging experiences and understandings, helping peers from one culture to understand the cultural assumptions necessary to understand texts transmitted to another culture for example.

Human beings do not of course change except slowly; it is probable that the processes of learning will remain much the same. But what has to change, quite rapidly, is our understanding of the pedagogical processes needed to enable educators (and, in this sense, a school student may well be an educator of his or her peers) to develop the information accessing and processing skills necessary to change information into knowledge and, in due course, to enable both educator and learner (who will often be the same person) to change knowledge into wisdom. This is the real educational challenge facing us as we approach the new millennium.

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Disseminating Engaged learning Strategies in the Middle School through Technology[1]

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Abstract: This paper is a report on the results of a small grant from the Corporation for Public Broadcast to disseminate engaged learning strategies in the middle school. Three university instructors worked with eight middle school teachers to integrate webquests, the Journey North Project, STELLA software and media literacy into the curriculum. A general process is described, along with three differing approaches for disseminating engaged learning strategies. Some results of the three interventions are given and a listserv-based process for a final reflection is described.

Introduction

In September of 1997, three faculty members at Southern Illinois University at Edwardsville (SIUE) attended the 4th Ernest L. Boyer Technology Summit that was held in Dallas.[2] At this conference we saw many new and exciting ways that technology is being integrated into K-12 education. Each of us was struck by different applications. However, all of us noticed an emphasis on an educational approach variously known as constructivism, active learning and engaged learning. We applied for and received a Next Step Grant[3] of $5000 from the Corporation for Public Broadcast the purpose of which was to explore different ways of effectively disseminating effective technology mediated constructivist practices at area middle schools.

Two of the faculty members already were well connected with North Middle School[4] in Godfrey, Illinois. SIUE's School of Education has sponsored an existing two-year project, known as the Bridges Project, which established and maintains a full professional development site at North. We, along with several other faculty members at Southern Illinois University at Edwardsville, have worked with both the preservice teacher/administrator cohort and with the North staff in a variety of ways. A third faculty member worked with two middle school teachers enrolled in classes he taught.

All three investigators committed to following a general process as described below. Later, when it was realized that the timeline was unrealistic, an extension of the Next Step Grant to the end of the year 1998 was asked for and granted.

1. Introduce different constructivist tools and approaches into three middle school settings, including a professional development school setting. (November, 1997-January, 1998)

2. Give professionals and preprofessionals an opportunity to explore the fit between these tools and approaches and the curriculum for which they are responsible. (November,1997-January, 1998)
3. Facilitate a process of curriculum augmentation, including coaching, training and group process, based on these tools and approaches. (February, 1998)
4. Facilitate setting up a workable system for evaluation and reflection. (February, 1998)
5. Monitor and facilitate the implementation of the curriculum augmentation. (March-May,1998)
6. Monitor and facilitate the evaluation and reflection. (March-May, 1998)
7. Write a paper for a professional conference. (June, 1998)

The Three Approaches.

Each investigator worked with a different medium. Investigator 1 worked with three middle school science teachers to integrate constructivist models for using the Internet and multimedia tools. Investigator 2 worked with 2 middle school teachers interested in applying modeling and simulation software to help students develop an in-depth understanding of the dynamic interrelationships within biological, social, and physical systems. Investigator 3 worked with two seventh grade teams consisting of teachers, preservice teachers and a preservice administrator to integrate constructivist models for multimedia literacy through the creation of webquests, web publishing lesson plans on media literacy, and the use of video in the classroom (Education and the Power of Public TV). A school-wide media literacy fair evolved during the exploration of this approach.

The first approach used the fact that two middle school instructors were also completing their final masters project under instructor one. One was a middle school home economics teacher and the other was an 8th grade science teacher. The home economics teacher wanted to disseminate Bernie Dodge's concept of a webquest[5], which is an on-line lesson or unit structured according to certain constructivist principles, to the North Middle School staff. Instructor 1 and the teacher conducted three training workshops, and on-site coaching followed this. The 10 participants included North teachers and several preservice teachers and administrators in training there. They learned the components of a webquest, and seven useful webquests resulted from the process including a Baroque music webquest and an Iditerod webquest. The home economics teacher made the learning environment pleasant by providing lunch and a boost of enthusiasm.

The 8th grade science teacher worked directly with instructor one to complete the project titled "Enhancing 8th Grade Students' Self-Directed Learning through the Journey North Project.[6] After reviewing the Journey North site, the science teacher formulated several objectives for his gifted class including identification of cities by longitude and latitude, scientifically identifying migratory paths of selected animals, determining the photoperiod for a Mystery class, and submitting researched questions to Journey North's Expert. The dominant instructional modality was small group instruction encouraging active learning, open-ended discussion, deductive reasoning, and peer interaction

regarding relevant issues within the project. Since Internet access was a problem at this school, the teacher seeded each small group with at least one student with home Internet access.

It is interesting to note that instructor 1 contacted, offered assistance to and provided materials to three other middle school teachers. These contacts have not proven to be fruitful for a number of reasons.

The second approach used was to present the tool, STELLA, to participants in a problem-based learning seminar offered at the university. STELLA is a modeling and simulation software package designed to help students build an understanding of the dynamic interrelationships within biological, social, and physical systems. Students and teachers can use the software to model virtually any system of interest by manipulating a few icons. Once the model is constructed, simulations provide the opportunity for students to test theories, observe results, and modify assumptions, thereby increasing their understanding of how things really work and how to make them work better.

STELLA is based upon the philosophy of systems thinking which emphasizes an understanding of how complex systems change over time and the interdependent nature of real life events and experiences. In an age when researchers, teachers, parents, and politicians are concerned with the need for active or engaged learning practices, systems thinking concepts have much to offer the educational world. The STELLA software program provides a practical way to operationalize these concepts in the classroom.

The CPB grant provided funds for us to purchase three copies of the STELLA software program. Two students within the Instructional Technology program at SIUE were in a class where the STELLA software was demonstrated. They volunteered to use the software in their middle school classrooms with the understanding that they would design an engaged learning lesson and report on its effectiveness. One of the teachers taught 7th grade mathematics and the other taught 7th grade science. Neither of the teachers received formal training in the use of the software.

The math teacher used STELLA to help his students understand the concept of at a deeper level than students were typically taught. To accomplish this, he used the software to develop a model that simulated the effects of medicine dosage and its effects upon animals. The teacher demonstrated the simulation to the whole class by asking the students to estimate the amount of medicine that needed to be given to a very sick animal. Small concentrations of the drug had no therapeutic value. Larger concentrations in the bloodstream had great therapeutic value. However, if too much medicine was administered, it became toxic. The students, task was to maintain therapeutic concentrations for as long as possible during a 48-hour period without killing the patient.

After the demonstration, ratios were integrated into the lesson as the teacher let the students work in groups of three. They were given roles as veterinarians and told to determine the optimal ratio of drips to seconds (i.e. a drip every X seconds) that needed to come out of the drip chamber to save the animal from dying. Several different animals with different dosage needs were presented to the children. The teacher reported that the students were completely enthralled with this activity. Many students requested use of the software to play with the simulation during free time.

The science teacher used a STELLA model to simulate Hooke's Law, which concerns the force and elasticity of a spring. The model simulated the relationship between weight, platform height, and the elasticity of a bungee cord. To demonstrate the model, the teacher asked her students to imagine they were bungee jumping off a 100-meter bridge. They were asked to determine whether they would be able to bungee jump off the bridge without touching the water, given their weight and the Hooke's constant (a numerical figure related to the elasticity of the bungee cord). The simulation graphically displayed the results of their decisions. After the demonstration, the students worked in small groups to determine the proper bungee cord elasticity for each person on a list of thrill seekers wanting to bungee jump. The students were asked to try the simulation for each person. If their calculations were wrong they could be the disastrous results.

This teacher also reported very positive results with the simulation. The students learned the concepts related to Hooke's law and enjoyed the process.

The third approach focused primarily on the area of media literacy. As a result of a series of discussions facilitated by investigator 3 on ways of helping middle school students to become media literate, teachers and their preservice Bridge students declared the month of April as a school wide "Media Focus Month". Teachers were asked to explore ways of using media within existing curriculum. Coaching was provided on why and how media literacy can be taught, the stages of media literacy, approaches to media literacy and ways of deconstructing media. Media was defined as that which transmits messages to large audiences, primarily print, radio, television, and Internet. Meetings were held to share ideas and lesson plans. Ideas, websites, and television programming schedules were posted on listservs for both practicing teachers and preservice teachers.

Rationale for this school-wide interdisciplinary unit included the fact that media is a "real world" resource to help middle school students make connections to a variety of content areas, a way of making learning meaningful for kids, and a tool for hands on classroom experiences. It also proved to be a link between schools and community.

An Internet site was posted and used as a reference, a resource, and an agenda for a series of training sessions. Teachers collected ideas were posted on the site and or made available to teachers on a disk.[7]

The culminating event of the month long media focus was a Media Fair held on April 16. Celebrities from KETC, PBS, and KMOV spoke to North Middle School students at 3 school-wide assemblies. Professionals from area newspapers, radio stations, advertising agencies, and universities conducted breakout sessions for smaller groups of students and teachers. All 450 students attended 1 breakout session on print, television, radio, and Internet media in addition to their participation in the 3 assemblies. Press coverage can be viewed at http://www.siue.edu/~ghawkin/mediafairpress.html

Data was collected from all teachers, 450 students, 13 preservice teachers, school administrators, and 23 presenters. Feedback was overwhelmingly positive with many unintended positive outcomes. The feedback is presently being used to plan another similar interdisciplinary unit in another middle school within the same school district.

The event optimized the constructivist approach to learning in that it evolved over time, and provided opportunities for both hands on and engaged learning experiences.

Presenters for breakout sessions were encouraged to involve students in hands-on activities. Simultaneous learning occurred as university students, school staff, and middle school students explored and learned together about the stages of media, approaches to media literacy, ways of teaching media literacy and media resources. Internet media resources are now being utilized on a regular basis in classrooms. More teachers are familiar with and utilizing PBS resources. The event also resulted in multiple staff development workshops in the region with similar events in area schools presently being planned.

Though the event was intended to promote media literacy among middle students, middle school teachers have become more aware and better informed about the power of media as a resource for classroom learning experiences.

A Reflection on the Three Approaches

Our reflection is still in process because the grant was extended to December 31, 1998. Some reflection is offered now but we are also putting into place a process that will result in a final evaluation.

The investigators tried a range of dissemination structures: 1) a formal process of curriculum development by two masters students completing their final process, 2) a college class demonstration of a product leading to volunteer teachers using that product in their teaching and 3) school-wide involvement in a day-long event involving assemblies and break-out sessions given by 28 media professional volunteers. In addition (4) two products were simply given to classroom teachers without much condition or prior agreement.

Here are some initial observations. We used a variety of tools and resources to help teachers do their job differently to engage students, but at no time did we ask them to add specific curricular objectives. The focus of the resources we introduced was on new things that are available today. We all facilitated the exploration of these tools with a minimum of direct instruction.

Instructor 1 selected five teachers who he knew from previous courses and contacts were "self-starters" and hard workers. With two of these teachers he used the final project process to effectively stimulate curriculum development. He required a three-page proposal with a timeline for turning in the project at various stages of development. Using face-to-face conferences and e-mail, he was able to coach and shape the project in helpful ways. In both cases, this lead to a meaningful dialog between teachers and this supervisor over and a deepened understanding of the nature of a constructivist environment and philosophy. He also used this process to conduct the summative evaluation. Since the other three teachers also met the self-starter qualification, it is likely that the lack of a formal structure and a requirement for doing the work resulted in their not following up on the lead.

Instructor 2 is well known for his interest and expertise in problem-based learning and his sensitive and effective coaching of students through a series of masters courses. In this case, the volunteers happened to be highly competent professionals with a deep interest in trying out current new learning strategies with their students. He is still in the process of reflecting on this process.

Instructor 3, a former middle school teacher designed activities involved students in real world. She used and modeled a team approach. She gave a questionnaire to students, teachers and presenters. From the analysis of these results she drew a number of conclusions. Teachers following students to media literacy sessions for a whole day gave these teachers an entry point for conversation with students that had not previously occurred, especially with the advisory classes that the day starts with. Kids who had learning disabilities did surprisingly well this was good information for the teachers. She will do a second day long media even with the following additions: give specific directions to presenters to have hands-on activities and to bring things to feel, see and touch, give presenters examples of engaged learning activities, and give kids and teachers input into selecting presenters. Two other conclusions were that the grant lent credibility to the event and that the children learned things that they'll remember forever.

Since our grant has not yet concluded, we have decided to institute the following formal process for completing our final reflection on our work. We will start a listserv called engaged for the three grant facilitators and their six middle school colleagues. We will seed this discussion with questions designed to provoke reflective thought on both the process and results of our interventions during the preceding year. Following discussions in January, the three facilitators will meet to write a final evaluation based on the listserv and our individual experience.

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[1] Updates to this project may be found at http://www.siue.edu/~jandris/boyer.html.

[2] The Ernest L. Boyer Technology Summits for Educators [http://ready.cpb.org/edtech/summits/index.html]

[3] Three Approaches to Engaged Learning in the Middle School via Technology [http://www.siue.edu/~jandris/boyer.html]

[4] North Middle School [http://www.siue.edu/~ghawkin/North.html]

[5] The Webquest Page [http://edweb.sdsu.edu/webquest/webquest.html]

[6] The Journey North Project [http://www.learner.org/jnorth/jnorth.html]

[77] Media in the Middle [http://www.siue.edu/~ghawkin/medialiteracy.html]

Extending Preservice School Experience through Telementoring

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Abstract
This telementoring project paired preservice teachers and inservice teachers in an idea exchange and in curriculum materials development. E-mail, a discussion area, and a Web site were utilized. Findings include the benefits to both teachers and preservice teachers and suggestions for developing a successful telementoring exchange. Suggestions for further research are included.

NCATE/ISTE standards (ISTE, 1998) require that students have a working knowledge of telecommunications and its use in the classroom. The State of Illinois and NCATE standards recommend more field based training such as Professional Development Schools (PDS) for preservice teachers. Although Illinois State continues to increase the number of PDS sites, increased field placement is difficult given the numbers of elementary education majors (over 2,000). This research examines how telementoring can provide introductory contact with K-12 classrooms as well as improve telecommunication skills.

Telementoring is defined as mentoring a group of novices through telecommunications by practitioners (Wrighton, 1993). Telementoring in this project is defined as mentoring preservice teachers through Internet by practicing teachers.

This is a follow-up study to the pilot study conducted fall 1997. A survey of supporting literature is presented in that article (Brehm, 1998). Based on students' and teachers' suggestions from the pilot study, modifications were made in the recruitment of mentors, building community, and the types of mentoring activities planned. Community between preservice teachers and mentors was built through pairing of a teacher with two students, an introductory e-mail exchange, the development of a collaborative project, and a mentor visit to the campus classroom.

After the initial introductory e-mail exchange, pairs identified a topic for a thematic unit or a literature focus unit that the classroom teacher was currently teaching or developing for the future. On-line activities continued throughout the semester related to the chosen unit. They also participated in the netWorkPlace (nWP) discussion area.

Methodology

Participants

Twenty-three preservice teachers in a language arts methods class and 13 inservice teachers representing either school districts participated in the research. The language arts methods class is taken in a block with three other methods classes usually during the junior year. Four weeks into the semester, students go out into local schools for four weeks full time. They then return to the classroom for the second half of the semester.

All participating teachers had been enrolled or were currently enrolled in graduate classes taught by the author. Eight teachers chose a $100 stipend from a HECA grant to participate, one chose one hour university credit, and four chose mentoring as a project in a doctoral class in which they were enrolled.

All student and mentor teachers had access to e-mail. Five mentor teachers from one school had access only through a school address on one computer located in the school library. Two of these teachers obtained individual e-mail addresses during the semester. The remaining eight teachers had convenient access from their classroom or home computers.

Data

Data were collected using questionnaires, interviews, e-mail exchanges, and netWorkPlace interactions. Questionnaires with Likert ratings and open-ended questions were administered to students at

the end of the class. They also completed outside of class an anonymous summary of their thoughts on the mentoring project. All thirteen participating teachers completed questionnaires and the researcher interviewed eleven.

The mean for each Likert question was calculated. Open ended questions and interviews were read and categories determined from the content. Categories were developed independently from students and teacher data. Categories were then described and frequencies in each reported.

Procedure

Teachers were assigned two preservice teachers who were enrolled in a Language Arts methods class. They communicated through e-mail and participated in a Web discussion. The discussion software used was netWorkPlace developed by NCSA at the University of Illinois. This software was chosen because it is organized in a building metaphor, which is easy to navigate and use.

Two students were assigned to each mentor by the author who matched student grade level requests as closely as possible. Due to the number of volunteer mentors, three mentors had only one student. Two weeks into Spring Semester 1998, students send get acquainted e-mail messages and their mentors responded. This was designed to begin building community between mentor teacher and his/her students. Students also ask for a list of several units that the teachers taught. Students choose a unit for which they wanted to develop a lesson plan. The student and the mentor determined goals for the unit together. Due to the time shortage, most mentors just supplied goals. Students spent weeks five through eight full time in local schools (clinicals). After Spring Break, they returned to the campus classroom to complete the semester. Each student located Web sites that fit with the teacher's unit and e-mailed those sites to his/her mentor teacher. Each student or student pair developed a lesson plan to fit the mentor's classroom. The mentor teachers provided feedback on the lesson plans, which were then turned into the instructor for grading.

Results

The data are reported beginning with the general evaluation of the project, proceeding with individual parts of the project, and concluding with suggestions from both the students and teachers. Results from the Likert scale questions are reported on a scale of one to five with one being the best rating. Data summaries are reported in the percent of responses of the group.

At the end of the semester, students were asking to rate the components of the class on a five point Likert scale anonymous questionnaire with one as the most useful. Twenty-one students of the 23 enrolled in the class, completed the questionnaire. Some of the components including the mentoring parts are shown in Table 1. Students rated all parts of the mentoring project and instructor presentations about average. Clinical experience consisting of four weeks in a school was rated as the most valuable part of the class.

Category	Rating
Clinical Experience	1.1
Textbook	2.3
Mentor Lesson Plan Feedback	3.1
Mentor e-mail	3.2
NetWorkPlace	3.3
Instructor Presentations	3.3

Table 1: Student numeric ratings of class instruction including mentoring activities on a questionnaire.

Students were also asked to reflect on the mentoring process including what they liked and disliked and suggestions for future projects. These reflections were written outside of class and were anonymous although some students choose to include their name. The overall ratings of the project fell into four categories of responses. The four categories shown in Table 2 emerged from the data. Figure 1 explains each category and lists sample student comments for each category.

Category	Number	Percent
Enthusiastic	9	43
Good	5	24
Fair	3	14
Poor	4	19

Table 2: Student overall evaluation of Telementoring Project from self-reported reflections.

Sample responses characterized as enthusiastic are as follows:

Beneficial
Enjoyed
Good idea – I learned a lot.

Responses characterized as good were generally positive but had a few frustrations as follows:

Good idea but some [corks] to be worked out
Overall mentor experience worked pretty well

Fair responses liked the idea but didn't gain much from the mentoring as follows:

Great idea but not much feedback so not useful
Needs a lot of revision

Poor responses were totally negative about the project as follows:

Waste of time
Did not like. Did not gain anything

Figure 1: Explanation of categories of student satisfaction with the mentoring process

Teachers completed an anonymous open-ended questionnaire on the telementoring project. Most choose to include their name on the questionnaire.

Seven teachers (53.8%) reported that both students had positive attitudes and were enthusiastic, two reported (15.4%) one student was enthusiastic but the other student did not correspond as often and was less involved. One reported (7.7%) that she didn't feel that her student "put much time or effort into her project". Three (23.1%) did not report student attitudes.

Teachers were ask whether or not they would be interested in mentor another semester. Eight (65%) responded that they would, four (30.8%) responded possibly, and one (7.7%) did not respond. The ones who responded "possibly" cited time and the actual presence of a preservice teacher from another university in the classroom. One said that her "junior block student from another university brought gifts and she missed that payback and the personal contact with the students that she was mentoring". One, who responded "yes", said that she would continue if there were some kind of compensation for the time that she invested. Of the eight who answered "yes", seven continued mentored during the fall semester 1998. The four possible and the one no response answers were from mentors who had access only through the school library.

On-line Interactions

The on-line interactions discussed in this section are nWP, e-mail, lesson plan activity, and building a virtual community. Students and teachers both reported good feeling about netWorkPlace (nWP). A student described nWP as a "Place to share ideas". Seven students made good comments while no bad comments were recorded. Five students mentioned that they liked the variety of ideas and perspectives on nWP. The following two quotes summarize student comments: "nWP provided many perspectives that the instructor alone could not provide" and "It was neat to see different ways that people answered my question". Two students who reported limited e-mail feedback from mentors were included in the group that made positive comments about nWP.

	Number	Percent	Number of messages	
Participated	9	69.2	Mean	Median
Read only	2	15.5	4.4	3.5
Did not Participate	2	15.4		

Table 3: Mentor teacher participation in netWorkPlace.

Eleven teachers (84.6%) reported positive comments such as "loved reading responses". Four (30.1%) reported spending extended amounts of time reading messages such as, "Got hooked when I accessed the site [netWorkPlace discussion] and began to read several items". Two teachers (15.4%) responded that they liked being able to access parts of the discussion that interested them rather than having to read all of the comments. Six (46.2%) reported using ideas posted on nWP in their classroom. Four teachers (30.8%) reported time as a factor limiting participation. The median of 3.5 interactions per teacher is more representative than the mean of 4.4 since one teacher participated thirteen timesStudents participated only as required except for two.

All teachers and students used e-mail to communicate and complete the requirements for the project. Five students (23.8%) reported using e-mail to discuss professional topics and ask questions not pertaining to this class. The five teachers (38.5%) who had limited computer access reported using it only as required, five (38.5%) reported using it more than required, and three (23.1%) did not report frequency of use.

During the revision stage, mentors reviewed student lesson plans. Six students (28.6%) reported receiving good professional feedback, two (9.5%) reported not much feedback, and 13 (61.9%) did not comment on feedback. Four students said that it was difficult to write a lesson plan for a classroom and students that they didn't know. Most teachers were enthusiastic about the lesson plans and the fresh ideas that they presented. Six students reported that they actually wanted to teach their lesson in the mentor's classroom.

Five teachers reported using the Web sites in their classrooms. One reported that her students couldn't find Web sites on the topic so she provided them. Students had received training on searching the Web as part of their class. The author assisted two students in defining keywords and choosing search tools to find appropriate web sites.

The initial e-mail exchanges and unit collaboration were designed to build community between students and mentors. NWP provided a place for sharing for the entire virtual community. Bringing the mentors to campus to present with their students at the conclusion of the semester was designed to be the culminating activity for the semester. Six students (28.6%) wanted to meet or at least see a picture of their mentor at the beginning of the semester. Three mentors (23.1%) voiced the same desire to "put a face with a name". Two students (9.5%) suggested an alternate means of communications such as the phone. One student (4.5%) liked the mentoring idea but just wanted to work in person with her mentor.

Barriers

Seven teachers (53.8%) reported time to be the biggest barrier to successful participation in the telementoring project. "Time prevented participation as much as I might have liked." Teachers from one school, who had access only after school from the school library, five (38.5%) reported that access was a problem.

Initially in class students complained about the length of time that it took to receive a response through e-mail. They wanted an immediate response. By the time that evaluations were completed at the end of the semester, only two students (9.5%) cited response time delays as a problem.

A few technical problems did occur. Some problems such as changed e-mail addresses and typing errors occurred at the beeinning of the project. The author called two mentors to verify e-mail addresses. The library aide at the school with only one e-mail address initially failed to distribute e-mail messages to mentors. This was discovered and corrected after a call from the author. One school district had temporary problems with their e-mail system. By two weeks into the project, all e-mail addresses were corrected and all contacts had been made.

Suggestions

The largest number of suggestions from both teachers and students was a call for stricter guidelines for lesson plans. Seven students (33.3%) and eight mentors (61.5%) suggested that more structure and guidance was needed to develop, revise, and evaluate the lesson plan. An example of teacher comments: "I needed to know specific expectations. The syllabus was not enough. I didn't know my part."

A student suggested that students and mentors be given a packet with an description of the lesson plan project and a rubric by which it would be graded.

Two students suggested that they be able to choose their own mentor so that their interests and grade level would more closely match. No other student suggestions occurred more than once.

Three mentors suggested the addition of chat room to allow real time interaction and quick responses to student questions and concerns. Two suggested that students be given a choice of options for their project such as creating a web page, WebQuest, or writing a lesson plan.

Discussion and Recommendations

This discussion is meant to both reflect on the data and to provide guidelines for people planning a mentoring project. In both telementoring projects that the author has conducted, there has been a disparity in overall ratings between numeric ratings using a Likert scale and self reported benefits in a narrative. Both reporting forms are anonymous allowing the same level of input without consequences. One possible explanation is the student perception that too much time was spent on technology or that students do not see the connection with language arts. The semester following this research, a former student stopped the author on campus to tell her how beneficial the telementoring was for her and that she was still e-mailing her mentor. She said that she didn't realize at the time how much she had benefited.

On-line Interactions

The four on-line interactions discussed in this section are nWP, e-mail, lesson plan activity, and building a virtual community. During both open discussions of a group of mentors at the end of the project, they emphasized how beneficial nWP was for them. One teacher commented that she couldn't tell who were students and who were teachers. Several other teachers agreed but suggested that comments from both were beneficial. Two teachers suggested on the questionnaires that the mentoring process be more of a learning experience for both groups rather than the mentor on the high end and the student on the low end. These finding support collegial rather than teacher/student relationships.

The author has found that the closer the content from a discussion area is tied to class work, the more beneficial it is for students. The instructor needs to monitor the discussion closely and include information from it at relevant points in class and encourage discussion of differing opinions that are posted. Students were urged to use information from nWP in presentations and written assignments such as the final examination. Used in these ways, it serves as another current resource for the class and as a connection between the real world of teaching and classroom theory.

E-mail must be easily accessible for both students and mentors. The problems of just one address per school have been described in this paper. A suggested requirement for all mentors is that they have private e-mail addresses and convenient access to their accounts.

Because of the almost overwhelming number of e-mail messages received by the instructor in this type of project, it is important to organize incoming message from the beginning. Create mailboxes or folders for each activity within the project. After each message is read and a reply is send, file the message in the appropriate place so the it can be retrieved as necessary or used for research data at a future date. Create a filter so that all messages from a project or class initially go into a folder for that class. Instruct the participants to include the class number or other identifying information as part of the Subject line so each message can be filtered into the proper mailbox.

Acknowledge all assignments promptly. E-mail is not perceived to be as reliable as the Post Office and people do not feel as secure using it. Encourage students using Eudora to choose the return receipt option. An automatic receipt relieves student anxiety and removes some of the load from the instructor.

When either a mentor or a student claim to have sent information that the other did not receive, the author suggests that both people send the instructor or moderator a carbon copy of the next several exchanges. This is to make sure that the messages did arrive and to give credit to the student. In the author's experience, this excuse occurs most often when assignments are late. This simple tactic removes the instructor from the need to determine who is right and alerts students that it is not a viable excuse.

The lesson plan was the most problematic activity of the project. A description of the lesson plan assignment with due dates was in the syllabus given to the students, e-mailed to the mentors, and posted on

the class web site. Although the anatomy of a lesson plan was discussed in class, the students were not given a specific form since the preferred form varies among instructors and classroom teachers. Mentors were instructed to give feedback as to how the lesson would work in their classroom. As reported in the data section, more detailed instructions and a rubric are suggested to make on-line activities go smoothly.

The author initially suggested that the mentors participate in the evaluation of the lesson plan in addition to providing feedback for the students. They responded that they did not want to be involved in the grading of the students. In most cases, the lesson plan was a good one and the mentors gave constructive feedback. In a few cases, the lesson plan was hastily written and not well developed or inappropriate for the classroom. Some mentors reported when interviewed that they were hesitant to give negative feedback to the student even though they felt that it was deserved. This placed the instructor in the awkward position of grading down a lesson plan that the mentoring teacher had said was acceptable. Another problem was that a few mentors gave very little feedback.

This lesson plan experience exemplifies the need for extra structure in distance education projects. The ideal approach is for the students, mentors, and the instructor to develop a rubric for assessing the lesson plan perhaps using nWP or a similar discussion or chat area. A sample rubric could be posted on the class Web site as a starting point. Time presents a problem in collaborative distance projects. Regardless of how it is developed, there needs to be a rubric to evaluate the lesson plan or other on-line assignments.

Utilizing the class Web page as a location for detailed information on assignments, a link to the discussion area, and e-mail to the instructor facilitates access. Students accessing the discussion group from the campus labs must carry a disk or enter the address of the discussion area since bookmarks or favorites cannot be saved on lab computers. With class Web site access, the student then needs to remember only one address to access all parts of the project.

A feeling of belonging to a virtual community is necessary for maximum satisfaction. Several ways have been presented in this paper. Suggestions from participants indicate that the face-to-face meeting should be at the beginning rather than the end of the project. An alternative might be the posting (if the site is closed to the public) or exchanging of digital pictures at the beginning of the project.

Implications for Future Study

Several issues arose from this research that need further study. Students report that some teachers are better mentor that others. What are the characteristics of a good telementor? The experience with the lesson plans points to the following question: Should the coordinator of the project be the instructor or a moderator not responsible for the evaluation of the students?

Mentor teacher attitudes were excellent but students reported less satisfaction with the mentoring process. How can the mentoring be structured to create less stress for students and improve their perceptions of the project?

The pilot project was only a discussion on nWP. While this project involved more interactions and connections between students and their mentors it was perceived by some students as focusing too heavily on technology. The question that follows is: What is the optimum amount of interaction for a project and what technological components are the most effective?

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Pre-Service, In-Service and Graduate On-Line Language Education

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Abstract: This paper reports on the effectiveness of using on-line second language/culture virtual seminars to maximize the contribution of international teachers, researchers and resourcesto an understanding of the multiple perspectives inherent in gaining an appreciation for intercultural communication. Observations and reflections made by students on questionnaires and in interviews in pre-service, in-service second language methodology couses and a graduate seminar on Narrative as Inquiry on Intercultural Communication attest to the potential of online courses to overcome some of the limitations of traditional seminars in promoting second language acquisition and an appreciation of intercultural communication.

Introduction

The globalization of information technology permits new approaches to second language/culture teacher preparation as well as to in-servicing and graduate program specializations. The rapid growth of national internet networks such as CANARIE in Canada, CA*netII in the PRC, TANet in Taiwan, SingAren in Singapore and their integration into larger networks such as APAN in the Asia-Pacific has made the emergence of virtual pre-service, in-service and graduate courses and virtual graduate programs for language/culture teachers around the globe a virtual reality. Yet the creation of highly interactive pre-service, in-service and graduate courses has not been fully realized and to date there are no highly interactive graduate seminars on inter-cultural communication using WebCT technology. Therefore, a test of the potential for a highly interactive on-line graduate seminar in a challenging area of intellectual pursuit on intercultural narratives is an ambitious yet needed goal to set. Consequently this interactive graduate seminar was created using extensive resources and URLS which are coded and organized to maximize students exposure to multiple perspectives when considering Narrative as Inquiry and Intercultural Communication in the Asia-Pacific. A piloting of this prototype was made so that students could compare the online experience with conventional seminar sessions on Narrative as Inquiry and Intercultural Narratives. As in previous studies of pre-service and in-service second language methodology courses (Carey & Crittenden,1998), dedicated students report that the on-line course provides far greater opportunities for exposure to and a great depth of analysis of resources. In addition, the organization of these online resources provides multiple perspectives on theory, research articles and paradigm biases that are difficult to attain in a conventional graduate seminar. Finally, the networking of in-service teachers and graduate students with education researchers and teachers from around the globe as a result of this virtual seminar demonstrates the potential of these technological tools to enhance and supplement conventional professional pre-service, in-service graduate seminars.

The majority of the world's students are attending school in a second or other language (Carey, 1996) in part due to the rapid global spread of English and other international languages. Thus there is a need for language planning in education (Carey, 1997) to ensure that students from these countries can master an international language to a level that their academic reading comprehension and writing production will permit them to contribute to academic research and publication, (Carey, 1998) at the university level. The internet provides a useful tool for providing academic material and courses to help achieve these ends. For the past few years I have been developing on-line supplements to regular lecture courses (Carey & Crittenden, 1998). The first critical stage of this sequence was the development of the Modern Languages Website (http://www.mled.lane.educ.ubc.ca) for second language/culture research and teaching. This website was developed in 1996 and is used extensively as a resource and supplement to the regular graduate courses that I teach. It has also been an invaluable aid in encouraging student teachers around the globe to become web-wise and to feed their enthusiasm for more resources and further connectivity. It continues also to be used by teachers and researchers around the world and receives from 200-800 hits a day. The evolution of the on-line courses

proceeded from using list-serves and the WWW as supplements to conventional classes to the second stage of offering the first "wired classroom" course in our Faculty in 1997. This first on-line course was a second language methodology course for teachers. Because this course was divided between course components that were on-line in the wired classroom, on-line components in the faculty computer lab and traditional lectures it was possible to consider how these different components were best integrated, how each component complemented the others and how students compared and evaluated these components. The students in these initial courses were quite mixed in their familiarity to the WWW and extensive tutorials and instructional time in the computer lab was also made a component of this courses. These language teachers, who were seeking to upgrade their knowledge of second language teaching methodology and educational technology were enthusiastic about the innovations in the course (Carey & Crittenden, 1998) and particularly found some features such as the asynchronous posting features of the bulletin boards highly useful.

The asynchronous bulletin board provided the impetus to consider a more complete exploitation of this resource because it represented the core of a virtual class seminar. I therefore sought to develop this component in a graduate on-line course using WebCT which would maximize interactivity in a challenging subject area. The goal was to create an on-line graduate seminar that was both more challenging and more fulfilling for students than a conventional seminar. Because many of us have memories of highly dynamic exchanges in graduate seminars and these often animated exchanges are the life-blood of learning, I thought it would be critical to determine if a virtual graduate seminar could create this type of lively exchanges that are so conducive to learning and to perhaps extend such a course to a group of graduate students who came from diverse origins in the Asia-Pacific. It was reasoned that those rare moments of lively and motivated exchanges that occur in a traditional seminar could be greatly increased in a virtual seminar that allowed for much greater opportunities for individual exchanges that was not bound by time and space considerations and therefore would create possibilities for a more equitable participation across culture, gender and ESL proficiency levels.

International pre-service, in-service and Graduate Students as Resources

The international pre-service, in-service and graduate students who enroll in my courses constitute a rich resource for adding multiple perspectives in approaching intercultural issues from diverse intercultural backgrounds. In addition, they offer feedback for evaluating the authenticity of published research articles on Asia-Pacific language/cultures through their critiques and research topics development. To fully appreciate this rich source of information and its contribution to the seminar's benefit, it is advantageous to encourage each of these students to search out, evaluate and elaborate course-relevant websites and other www resources that are originating from their home culture/s. To effect this I sought to maximize the links to diverse researchers in universities around the globe that would treat the particular topics of the course. However, I also wanted to offer an extremely rich variety of resources on any of these topics across cultures. Therefore, a number of lists of specialized websites have been developed for each of the dedicated topics within the course. For example, on a given theorist such as Foucault, there are a variety of biographies, critiques and explications of his works and these are written for students with different levels of prior knowledge. This allows students from different cultural and educational backgrounds to progress through the multiple perspectives on Foucault's works at different levels of academic difficulty.

This provides students not only with multiple perspectives and multiply encoded representations of theorists works associated with different contexts, but also provides students a rich choice through which to develop their academic vocabulary and reading comprehension skills as well as their academic writing for different audiences. This is an important aspect of the course because for almost all of these international students English is their second language and by providing students with such a diversity of interesting materials, there are added benefits of improving their academic reading comprehension. In addition, because students were encouraged to write extensively each day on the bulletin board, it was thought this would greatly increase their academic vocabulary acquisition and writing ability. Finally, and most importantly, the course is designed to maximize the interchange between student and professor and between students from diverse cultural perspectives. This most vital aspect of a conventional graduate seminar was maximized through several measures in this virtual seminar. Again, it was reasoned that the diversity of cultural backgrounds and viewpoints was a highly valued asset.

There are numerous reasons for the advantages of the asynchronous bulletin board over a regular seminar for promoting discussion. First, many students including ESL students are reticent about speaking out in conventional graduate seminars due to their lack of confidence about the material, their lack of time to formulate

their question, their insecurity in their second language, the realization that they are taking up precious seminar time and a host of other reasons that limit their seminar participation. Similarly, there are occasional students who love to hear themselves speak, think their ideas are the most profound, ask questions which have been extensively dealt with in the previous seminar that they missed and feel it is only right that they monopolize conventional seminar time. In addition, there are inherent severe time limits in a conventional seminar and a lack of opportunity to formulate or express questions in this limited class time. Moreover, the important questions for students usually occur after the seminar when students are mulling over the class notes and readings and when there is no-one to discuss these burning issues with. This on-line seminar sought to overcome these limitations of a conventional seminar and to preserve and to expand the essential and critically important component of a traditional seminar by providing extensive opportunities for student and professor to exchange perspectives on questions of vital interest to the students who come from diverse backgrounds.

The particular reasons for choosing to develop this specific highly interactive on-line graduate seminar was to fully develop the utility of an on-line course using WebCT technology options and to simultaneously demonstrate that an on-line seminar should be able to equal or exceed the dynamic nature of learning that can occur in a highly interactive graduate seminar. The key prerequisites to a successful graduate seminar is to provide the students the opportunity to become actively involved in debate on issues that are of critical importance to them. At their best, graduate seminars include discussion between rival viewpoints that can become animated and involve student affect and ego involvement. It was hoped that this on-line seminar would augment the opportunities for such critical learning situations. The key point and challenge in developing this graduate seminar was to fully exploit the potential for a highly interactive course that empowers students by providing them with the autonomy, the individualization, the self-paced flexibility and the greatly expanded scope of resources that should make it possible to exceed the effectiveness of a traditional seminar. To date, there is no other graduate seminar using WebCT technology that is as highly interactive in the dynamic sense that this course is designed to be. Too often, the great potential of on-line courses are obviated by course authors and developers who think in traditional terms of conventional courses and thereby creating "shovel on" courses that represent traditional courses loaded onto an on-line shell. In addition, I sought to maximize the resources that were immediately available for the students. Too often, in traditional graduate courses, the resources are limited for cost reasons to a particular text or set of course readings. In this course, I sought to organize an extremely rich and organized set of readings that students could download. This would allow students to gain multiple perspectives on any particular theory or works of a particular researcher on a theoretical viewpoint. This requirement also enabled students to have access to readings that were at various levels of expertise on a given topic to match their individual existing schemas or prior knowledge on this topic. Such an individualized and flexible approach should also encourage students to acquire a much greater breadth and depth of comprehension of any theory, research project or paradigm bias. Consequently, they should be in a much better position to have greater comprehension of a theoretical viewpoint on narrative inquiry or to competently challenge the interpretation of research results.

Similarly, I wanted these international graduate students who come from diverse countries to be able to explore the research and theory from other countries and universities while at the same time, where possible, acting as authoritative resource people in the seminar for their particular country and background when appropriate to the other students. This further encouraged me to maximize the on-line journal articles which provide an excellent opportunity for both ESL and native speakers to develop their academic reading comprehension and their academic writing for academic journals by increasing their interest in the diversity of topics. It was also reasoned that students would spend more time exploring diverse on-line academic journals than making a major trip to the library as required in a conventional course. Moreover, I thought, by requiring students to post each day their academic writing on discussions and critiques of assignments for the professor and fellow students that this would promote a higher level of writing and discussion than would occur in a regular seminar. In addition, because students would have the time to compose their messages and to research further the articles or arguments that they were querying before posting, it was reasoned that students could benefit more than they would in an conventional seminar. Furthermore, because students would not be as pressured by time constraints, they might have time to pose more questions and offer more comments of a higher quality that there would not be the time for in a regular seminar.

In general, there are several reasons for various components in the course to be more conductive to higher levels of discussion and critique, for students to learn more about academic composition and journal writing and for students to have a greater opportunity generally to learn more on the importance of academic writing. Finally, for the professor, who is often too concerned with covering additional material in the seminar

and unable to deal with each student sufficiently , the on-line seminar sought to offer the opportunity for answering and developing each students question in a more responsible and extensive sequence.

What is critical in these interactive courses is for the graduate students to take ownership of the resources that they are introduced to and to delve into those resources that are most motivating to the individual student and appropriate to their level of prior knowledge and interest. To this end students are provided with information on regional networks such as APAN and are given extensive experience at locating individual specialists from around the globe and then encouraged to network with them directly on their websites and e mail. We now know that students do tend to be more creative in utilizing on-line activities when that work is done in their home computer environment and this is part of taking ownership of their interactive seminar. Their preference in working in their home environment may be in part due to the fact that students in their own environment and context are more accustomed to assimilating information in their idiosyncratic manner that is more retrievable and related to their daily lifestyle. Thus, students are repeatedly encouraged to take ownership of the course.

Enhanced Interactivity

Using the WebCT package allows each student to asynchronously post a question, report, critique or first version of a research proposal or term paper on the bulletin board which can then be read by the professor or any student. The students have adequate time to post intelligent well formulated questions and this important process of formulating the question and composing it in appropriately nuanced terminology is a critical process to acquiring academic composition skills. Students are also encouraged to post relevant e mail that they may have received from significant researchers from around the globe and that may buttress the students claims or point of view. Moreover, the professor has adequate time to answer and critique the question and cite appropriate websites, resources and commentary without cutting into the limited time of a conventional seminar to answer questions that may be of limited interest to other students. Students can also answer all questions and offer diverse resources and websites that they may have uncovered from their own work and interests. In this sense, there is a multiplexing effect of the current availability of resources and students are empowered to be peer and collegial seminar members. There is therefore the potential to develop a sense of "community of scholars" and a greater sense of student participation in their on-line seminar. Because the seminar can become quite student centered, the occasional professor may feel threatened by having to share the podium but can at least entertain the consoling thought that no individual professor can have the multiple perspectives and resources that such an international student body provided with such unlimited resources may be able to contribute.

Student Seminar Participation Evaluation.

An additional advantage of the bulletin board and chat lines feature of the WebCT package is that each student can be required to make a specific number of comments each day on questions posed by the professor and/or students. This is a major advantage over a conventional seminar where grading the students participation is often too subjective and prone to non-accountability. Using the WebCT approach, at any time during the course, it is possible to have a print-out of each student's seminar participation in answering questions on readings and resources, and critiquing initial versions of students term papers and quizzes. Consequently, it is possible to more defensibly and accountably grade the quality and quantity of each students participation in each of the on-line discussion components of the course. Therefore, it is possible to greatly encourage and augment the level of all students participation by increasing the proportion of the seminar grade that is dedicated to student participation in the seminar. This is not possible in a conventional seminar since there is no record of student participation and assigned grades for participation are often indefensible. This can further lead to a lack of students motivation to participate in the conventional seminar since their grade is primarily on their term paper. Moreover, students do not have equal opportunity in a conventional seminar to participate for the diverse reasons stated above. To ensure student seminar participation in this online seminar, students are also required to post the first version of their term paper, research proposal or other seminar assignment on the bulletin board. Each student can then be required to critique and suggest revisions and additional resources for the proposal or paper. The opportunity for promoting collaboration and cooperation between pairs and groups of students who are interested in particular research topics is therefore greatly increased over that in a conventional seminar. Again, it is important to realize that the wealth of expertise that international students bring to the discussion of

language/cultural issues in the Asia-Pacific is a major asset that can be shared by involving the students in such peer evaluation and collaborative and cooperative research proposal development. In addition, students can post questions, critiques, and outstanding website URLs they have found for themselves and their colleagues, on the asynchronous bulletin board. This allows the professor and students to respond to any of the above whenever they have the time, interest or additional resources to contribute to the ongoing discussion.

Live F/F seminars

It is of course possible to supplement this on-line course with one or more live face to face seminars for select interest groups or all of the seminar students when opportunity exists. It is also possible to use the WebCT online curse as a supplement to a conventional face to face seminar. I have piloted such a course and for certain interest groups it is possible to develop a seminar with both alternative modes of delivery. Moreover, it is possible to offer an entire program towards a virtual M.A. degree by on-line courses or to simply offer a single on-line course as an option in a conventional Masters program.

Off-Shore Students

One of the major advantages of the WebCT on-line seminar is that graduate students who are working anywhere around the globe can be enrolled in the seminar. This is another aspect of the seminar that can be appropriately utilized to access the resources that such international students offer in diverse countries. At present, there are professors in diverse universities throughout Asia who would like to enroll in such a course while they are continuing to do their research in their respective countries. Such graduate students can also offer current insights into development in their countries. As the speed of change increases in the Asia-Pacific arena such current resources are fundamental to understanding the unfolding changes in the languages, literatures and cultures in these countries. Having other professors in these countries as online students or as online team teachers can greatly enrich the seminar delivery and discussion.

Conclusions

Global interconnectivity provides in-service, pre-service and graduate teachers with access to far richer professional contact for the study of second languages/cultures and their intercultural and interlingual variants. In the quarter century that I have been teaching, this is the most significant innovation that I have experienced to improve the quality and depth of student involvement in seminars while promoting the students improvement in academic reading comprehension and academic writing production. Due to the rapid global spread of English as the language of academic, economic and international communication, ESL competence has become a major factor of education at the tertiary level for international students. With the growth of the potential for international students to register in virtual courses and graduate programs such online seminars allow the expertise from graduate students around the globe to be shared with other graduate students and to permit a much higher attainment of collaborative and cooperative study and research. The enhanced resources that online courses provide should translate into higher academic standards. The Web CT highly interactive on-line graduate seminar allows for the enhancement of the traditional graduate seminar which is the primary building block of highly specialized graduate research and theses. It provides a means to expand on the critical interaction in graduate seminars that promotes motivated debate and critical thinking on the multiple perspective that such culturally diverse students bring to the discussion of research and theory. The format of the seminar encouraged the promotion of intercultural perspectives while also raising critical and multiple perspectives on such fundamental dualisms as that between positivism and narrative inquiry. Global interconnectivity promises a much higher level of appreciation of the intricacies of studying the multiple perspectives provided interculturalism and the implication for pedagogy of second laguage/cultures.

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Technology Training in Foreign Language Teacher Education: The University of Colorado's ATLAS Project

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Abstract: The paper describes the present use of computer technology in foreign language teaching and discusses the knowledge and skills in technology required of foreign language faculty and of graduate students in foreign languages entering the job market, focusing especially on the Foreign Language Education component of an on-going project funded by the Alliance for Technology, Learning and Society (ATLAS) at the University of Colorado in Boulder. This project aims to develop interactive lessons for language courses using the World Wide Web and CD-ROMs. With consultation with faculty, graduate assistants in six languages are designing and developing interactive Web lessons. The training of these graduate students will be a major focus of this article.

The Present Use of Technology in Foreign Language Teaching

The changes taking place in foreign language teaching today are not to be found in the goals of instruction or in the methods used to achieve these goals. At the present time, communication in a foreign language is the primary goal, as it has been for a decade or more, and the methods of instruction that promote communication are most prevalent. It is rather in the increasing use of computer technology to support foreign language learning that change is most apparent.

Computers have not made the inroads into foreign language teaching (or into the humanities in general) that they have made into the natural sciences and engineering, but significant changes are clearly underway. In probably all colleges and universities, language laboratories with their audio tapes and tape recorders have been at least partially replaced or are supplemented by computer laboratories. Audio tape is giving way to digital audio. The lab technician who maintained the tape recorders is being replaced by the computer expert. The nature of the technology is changing, and more of it is used.

How does technology support the learning of communication skills in a foreign language? The use of multimedia and the World Wide Web is increasing greatly. The benefit of the World Wide Web for foreign language learning is that it provides, in a quantity and variety never available before, an easily accessible source of authentic cultural materials from the countries in which the target languages are spoken. The use of e-mail to communicate with an instructor, other students, or students in a foreign country is a valuable communicative experience.

What do foreign language teachers in particular need to know about technology? It is necessary here to distinguish between the use and development of computer-based language learning resources. It is certain that in the years ahead all foreign language teachers will be expected to know how to make use of this technology in their classrooms and to be aware of the pedagogical implications of its use. They will need to know how to integrate it into their courses, how to use it to reach the goals they have for their students..

Technology Training for Foreign Language Teachers

The increasing use of technology in language teaching necessitates a change in the education of foreign language teachers. This paper is concerned particularly with the training of graduate students and future secondary school teachers in the uses of computer technology for instruction. A related, important issue, the in-service training of faculty and secondary school teachers will only be touched upon here.

Students now leaving colleges and universities to teach at the secondary or tertiary level clearly need to have skills and knowledge in this area. A large percentage of college job listings describe knowledge of the use of technology as required or desirable. Graduate students entering the job market and faculty seeking positions are at a disadvantage if they do not have some knowledge of technology.

Training in the use of technology for graduate students who are about to look for their first job has become an essential part of their education, but the means of providing them with this training are now only in the process of being put into place. A number of different training options are available. Courses on the methodology of teaching foreign languages incorporate some technology training, depending on the expertise of instructors of these courses and the availability and use of guest speakers. Workshops and training sessions may be given. At the University of Colorado in Boulder a new technology course for foreign language teaching titled "Multimedia Applications in Second/Foreign Language Education" has been introduced. An innovative use by the Anderson Language Technology Center (ALTEC) of graduate student liaisons with the foreign language departments has provided experience for these students in the area of technology.

Involvement in projects that focus on the development of language learning materials has proved to be a valuable source of training for both graduate students and faculty. A project funded in 1996 by the University of Colorado used the Libra program, a HyperCard-like authoring program, for the development of multimedia foreign language lessons with videodiscs. One of the benefits of this work was the realization that participation in a project of this kind could serve as a means of training graduate students and faculty in the use of technology. The experiences obtained by several graduate students with the Libra project played an important role in their acquisition of their first full-time position. Our present project for the development of interactive World Wide Web language lessons, which was funded by the University of Colorado at Boulder's ATLAS initiative, will be the focus of the rest of this paper.

The University of Colorado's ATLAS Project

At the University of Colorado at Boulder a new campus wide initiative, the Alliance for Teaching, Learning, and Society (ATLAS) has been created to promote excellence in teaching, curriculum, research, and educational outreach through the integration of information and communication technology into the classroom and learning environment. ATLAS supports all university programs that combine technology, arts and media. It also promotes projects that explore the impact of technology in society. All of these goals are present in our project "Foreign Languages at a Distance: The Next Step in Interactive Language Learning" which was funded by ATLAS for the academic year 1998-1999.

With grant support from the ATLAS initiative a group of foreign language faculty and the Anderson Language Technology Center (ALTEC) at the University of Colorado at Boulder are working together with graduate students to design foreign language interactive lessons in the World Wide Web. This project to create interactive language lessons on the Web has brought together four different language departments (East Asian Languages, French and Italian, Germanic and Slavic Languages, and Spanish and Portuguese), and graduate students and participating faculty from six different languages (Chinese, French, German, Italian, Japanese, and Spanish), under the umbrella of the Anderson Language Technology Center (ALTEC). Each department has designed their language-specific pages to accommodate their curricular needs. Some of the pages concentrate on reading, others on listening comprehension and cultural activities, others on developing level-appropriate language exercises on the Web. The overall goal of this project is to make these on-line materials part of the regular curriculum. This will add breath and variety to language

activities and will increase the length of exposure to actual language use. When fully implemented the results of this project will directly impact approximately 5000 students in lower division language courses.

As part of the ATLAS initiative goals, at the same time as we are creating this new learning resources for our students, we are carefully studying the effects the use of this technology will have on actual learning. We have already conducted surveys on language attitude, and we are developing evaluation measures to ascertain both the quantitative and qualitative effects that the use of this new technology will have on our students language development.

Part of the problem presented by the introduction of new methods and technologies to the learning process in general, and to foreign language learning in particular, is the need to familiarize the instructors with them. The foreign language profession is so tied up with the need to conduct widely accepted research and publish, to teach, and to help with departmental administrative needs, that little, if any, time at all, is left to be dedicated to the learning of a completely new field which requires extensive training. This is problematic enough, but to this we have to add the lack of recognition the time dedicated to the development of new technology learning tools is receiving nowadays at the time rank and tenure decisions are made. Highly qualified and motivated instructors are seeing the need to develop new ways of teaching with technology, but they see their future as faculty members compromised by the lack of time to do it all if their work on development of technology-based teaching materials is not given the proper weight in their rank and tenure evaluations.

One way in which we are trying to even up the field is to offer this technology training to our future teachers before they leave the university. One very important goal of this project is to use the development of new teaching materials as a way to introduce our student-teachers to the technical knowledge needed to use technology in their teaching, as well as to the evaluation process needed to design pedagogically sound teaching materials. Through the participation of faculty members together with graduate students we are narrowing the gap between these two populations and technology. It is hoped this training will make them better teachers as they make decisions on what to teach, how to teach it, and how to evaluate if learning took place.

The selection of the initial participating members was conducted at two levels. All faculty members, and some graduate assistants self-identified themselves through their previous interest in this subject. We have to mention that the amount of faculty members interested in this field is at this time limited, not only because of lack of motivation, but because of time constraints. In some departments the graduate assistants were selected from a good number of interested students. The selection was based on interest, experience, and/or how at ease the interested students felt with technology. Consideration was also given to how far away from entering the job market these students were. If we had students in the last stages of their careers without enough experience with technology in foreign language teaching, they were considered first. We look at technology in foreign language teaching as a way to give graduate students an edge when entering a highly competitive job market.

We have seen how a project which integrates the use of technology with foreign language learning, student-teacher training, and research on the effects of teaching with technology can be incorporated into foreign language departments through collaboration and communication at different levels. We have learned that departments and universities need to allocate more resources to technology training and assistance for their faculty, students, and staff. If we want our faculty members to develop pedagogically sound ways in which to teach with technology, they should be provided with the time and recognition needed to produce effective teaching tools which will affect the quality of education significantly.

Evaluating Software and its Effectiveness in Literacy Development in the High Needs Learner

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Abstract: The purpose of the project was to assess software programs that have been designed to assist in literacy development of students. When assessing the software programs, one of the main foci concentrated on the usability of these programs by students who were identified as high-needs in literacy development. Other foci include ......The two software programs assessed were, "WiggleWorks" by Scholastics and "Reading Blasters Jr", by Davidson.

Introduction

Norris (1994) notes, "that the one common thread in successful educational programs for the at-risk is individual attention."(p.12) With class sizes staying at considerably high numbers, the means by which the teacher can provide these individualized programs must be addressed. With technology becoming very commonplace in today's schools, teachers should have the opportunity to assess those software programs that may be used to design individualized programs for their students. This is particularly important for those students who require a more highly structured individualized program. Classroom learning environments according to Norris (1994) , must be flexible and suited to each student's needs and abilities. Teachers should assume the role of facilitator and guide with the knowledge that each student is an individual with a unique learning style. Self-paced instruction and concentration on basic skills, with an emphasis on thinking and coping skills, appears to be particularly effective. (p.12)

As a teacher of the Reading Recovery Program, (Marie Clay, 1972), I have had the opportunity to work with those children, at the Grade 1 level, who were well behind their peers in developing appropriate reading skills. The program is designed so that at-risk children, who show difficulty in acquiring those reading skills that are necessary to make them independent readers, receive one half-hour of intense one-on-one assistance from the Reading Recovery teacher to enable them to become independent readers. Because of the prescriptive and restrictive structure of the Reading Recovery program, students were required to keep on task so that each component of the program could be completed within a half-hour framework.

. In reflecting upon the techniques that were used in the Reading Recovery program, I began to think about the possibility of using computers as a tool for assisting the at-risk reader. As part of my work with my Reading Recovery students, I was able to explore the use of the computer in a component of the program called , "Roaming Around the Known". Roaming around the known provides the student and teacher with the opportunity to explore freely and creatively, the process of reading and writing text. I used two educational software programs at that time and they were, "WiggleWorks" by Scholastics and "Reading Blasters Jr." by Davidson. The students enjoyed the opportunity to work with these programs and expressed disappointment when our "Roaming Around the Known" sessions ended. With this experience in mind, I wanted to explore the possibility for teachers to use software programs within their own classrooms in addressing the needs of students who were at-risk in developing the reading skills required to grow as an independent reader.

At-risk students quite often feel a lack of personal control of their destiny due to experiential, physical, mental or language disabilities and are found to respond well to educational programs that empower them to take control of their learning. With the ever-increasing possibility of computer use in our schools it is important to ask whether or not this technology might assist teachers in facilitating at-risk students to take control over their learning and develop effective literacy strategies? Based on my initial observations I would have to reply in the affirmative. Computer technology has improved a great deal over

the past ten years and many programs have been designed so that the user can become a part of the software program. This interaction between child and program acts as a motivational tool for the child. If software programs have been appropriately selected they should provide individualized instruction that addresses the unique needs of the intended audience. Individualized instruction, according to Norris (1994), "[b]y far has been the single most effective one for teaching at-risk students." (p.12)

How does one set about evaluating a software program?

When selecting software to be used for instructional purposes, it is important that teachers have a clear understanding of what it is they want to use the program for, is aware the varying levels of independent learning their students are at. Programs must be compatible with the curriculum area in which they are intended to be used in. Additionally, the programs should be compatible with computers that exist within the schools. In assessing software programs, there are many varieties of check lists available for teachers to use. Of course the best evaluations of software can take place if teachers have actively used the programs themselves keeping in mind the abilities of the students in their class.
When trying to establish guidelines for this project, I found that those developed by Marjorie Simic(1990) best suited my needs.

1. Computer instruction in reading should focus on meaning and stress reading comprehension.
2. Computer instruction in reading should foster active involvement and stimulate thinking.
3. Computer instruction in reading should support and extend students' knowledge of text structures.
4. Computer instruction in reading should make use of content from a wide range of subject areas.
5. Computer instruction in reading should link reading and writing. (ERIC..)

Matthews (1996) notes that "Crucial question(s) (are) to determine if the text is narrated...(or)...if the text is superimposed over the illustrations? Can the narration be turned off(?). Do the illustrations...enhanc(e)...or...distract the reader? Does the program offer textbook version?" (p.12)

The above guidelines by Simic and questions by Matthews provided the framework for the evaluation techniques used in assessing the software programs that were used in this project.

Procedures

I wonder if you should use I rather than the teacher?

Prior to implementation of the project, I had an opportunity to work with the programs so that an understanding of the program and its applications could be acquired . In addition it is felt that, the programs, just like any other teaching tool that is being used by the classroom teacher, should be examined closely to insure that they are acceptable and potentially lend themselves to meeting the needs of the students selected to use them.

Students of both groups were instructed on how to access the programs they were using. Thus, two sessions of one-half hour each were set aside for this purpose. Upon completion of the two sessions, the students were then encouraged to work independently with the programs seeking the assistance of the teacher only if it was absolutely necessary. The teacher acted as an observer, never straying, far from those students who were working at the computers. Sessions usually took place during a writing period so that the exercise would lend itself to being a part of the Language Arts program.

At the end of the three week period, students were asked what they liked and did not like about the program they were working with. It was felt that this was a major component of the assessment process because the goal is to select programs that encourage success while developing independent learning skills in students. During that three week period, students who were selected to take part in the project were encouraged to help other students become familiar with the software programs. This was done to boost the participants self-esteem and to include others in the class who may have felt left out.

Findings

In summing up the findings of the project, an analysis of each of the software programs assessed will be addressed separately.

WiggleWorks

The first to be discussed is the software program by Scholastics entitled "WiggleWorks". This program was used by the three Group A students in the grade one-two classroom. The following describes the positive characteristics and applications of the program.

The students who used the program really enjoyed the bright colorful graphics which were used to encourage interaction between the student and the program. Students found that the colorful illustrations in the texts were very appealing. The teacher did not find that either the colorful graphics or illustrations distracted the children as they worked with the programs. When reading the text components, the children were observed as being as intent on listening to the story as they were in looking at the pictures.

The students did have the option having stories narrated by the computer or narration could be turned off by either the teacher or the student. This option allows the student to read the story on their own. In addition text can be selected by the student, in the form of individual words, or phrases so that feedback could immediately be obtained if a child was uncertain they had read the text correctly. This is a definite asset for software programs to possess when the teacher is trying to encourage independence in the developing reader.

The magnetic board component of the program allows children to construct words on their own. They may select words from the story they have just read and practice spelling those or perhaps use them to construct new words. A procedure that is similar to that of the Reading Recovery Program called "Making and Breaking". Children are able to create their own dictionary containing words that they are familiar with and perhaps will retrieve at a later time when creating there own stories.

Children are able to record their own stories by two methods. They may chose from a voice recorded method or can use the keyboard to type their own stories. For those students who feel more comfortable using a "mouse", an on-screen keyboard can be accessed for their use.

Students are able to create their own stories that include illustrations generated by themselves. This application encourages a feeling of ownership and the children were anxious to share their finished projects with other students in the class.

The icons on the screen are considered to be user friendly, however it was and is necessary for the teacher to insure that students understand what applications are relevant to each one. Some children will feel relatively comfortable with the use of these icons after a brief introduction but, students who are recognized as high-needs may require more assistance so that they do not become discouraged. However, "WiggleWorks" definitely was motivational in that the students remained on-task for most of the sessions.

The file manager programs were found to be excellent. The teacher was able to log-on and access any child's folder. This was found to be a wonderful tool to assess a child's progress and to specialize a child's session on the computer. This information could be printed so that the teacher could have access to a hard copy of the child's progress.

Any program that includes tapes or books as a part of their software package is a plus and "WiggleWorks" included both. As well, lesson plans were included for the teacher to use as a guide.

The program was definitely designed as an affective tool that could be used as a part of an early elementary classroom's Language Arts program. The program is flexible and could be used effectively by the teacher who is seeking a program that could lend itself to a cross curricular -approach. In addition, this program could be used successfully in designing a language curriculum to meet the needs of the high-needs learner.

There are very few disadvantages to this program. However, it is felt that note should be made of these. First, if schools are not equipped with labs or mobile computers, the use of this program within the classroom would have to be planned around other activities that are taking place at the same time. To gain the full benefits of the program, it is necessary that the children are able to have the sound turned on. Headphones are an option but can act as a distraction if the child involved in the program learns better by speaking their thoughts out loud. The teacher needs to consider the learning environment of both the students using the program and those who are not.

An additional drawback was for those students who liked to include a great deal of text on their storybook pages. There is a limitation of eight lines of text per page. For the average grade one student in the beginning, the eight line limitation would not be a factor. However, as students of this level become

more proficient with their writing skills, some level of frustration may be experienced as they try to limit what they want to write.

Reading Blasters Jr.

Group B, consisted of two grade two students who were identified as being high-needs students by their classroom teacher. Further assessment was done using the Diagnostic Survey used in the Reading Recovery Program. These students were identified as being able to read at an early to middle grade one level. These students were also receiving resource twice a week. It was decided that because of the special needs of these two students that they would participate in the project, using the "Reading Blasters Jr." program. This program is designed to assist students in developing early reading skills.

The program provides a phonetic approach for those students who require practice in the development of reading skills. The program introduces the students to those easy-to-hear consonants as initial letters in words. The new words that are introduced in each level of the program are similar in structure and usually have word endings that are common.

The goal of the students, as they move through this program is to obtain a new status level as crew members aboard the Reading Blaster's rocket ship. The participants visit planets where they are asked to complete a specific task. As the child progresses through the levels in the program, the approach to each task remains the same but what is required to be done changes as the program moves from teaching about word beginnings, to word endings and changes that take place within words.

The program is user friendly and could be operated by the students with relative ease. Students can access the program by clicking on the appropriate icon and than logging into the program by clicking on their own name.

The program begins by describing what the user will be required to accomplish before moving on to the next level.. An explanation of what is to be expected of the child is given at the beginning of each level. A visual guide is provided so that the student can visualize the route he/she will be taking.

The students enjoyed the colorful graphics and developed somewhat of a relationship with the characters that appeared consistently throughout the exercises. The program does have some hidden features that are useful as entertainment tools but soon became boring to the user because they were repetitive. This would not necessarily be a problem because the child would not be encouraged to waste their time exploring as opposed to staying on task.

As students completed each level, they were awarded with a certificate congratulating them on their progress. The certificate could be retrieved by clicking on the mailbox. While in the mailbox, the child has the option of completing a letter that has the major components already in place. This does encourage use of the keyboard and does provide some writing to be done. This type of format would be appropriate for the high-needs learner as it provides an outline for them to follow, however, this type of application does not encourage a great deal of creative writing to take place.

The last component of each level is a visit to the planet of the Story Heads. Here the child has an opportunity to practice listening skills and sorting skills. Once they have successfully sorted out the sequence of the story, they can than go on to read the story. The child has the option of listening to the story while it is read by a narrator or read the story on their own. If the child chooses to read on their own, the program does provide assistance for the child if they wish to confirm the pronunciation of a word.

It was agreed that this program would be beneficial for those students who required practice in developing word skills. The teacher would be required to be familiar with this program so that curriculum activities could be designed to compliment the use of this program. An added feature of the program is that it comes with a complete guide and black-line masters that can be used as supplementary material to the program.

As with the first group, students of Group B were encouraged to demonstrate to other classmates how the program worked. Students of this group were eager to do this activity because they became the teacher and leader of the instructional process.

Conclusions

As with any instructional tool that a teacher selects to use as a part of their curriculum, it is important for them to assess the value of that tool. Does it lend itself to the curriculum that is being taught?

Will the instructional tool meet the needs of those students who will be using it? Does it encourage independent learning to take place? When acquiring software programs for the classroom, it is very important that the teacher takes the time to use the program themselves because they know best what is required within their classrooms.

It was found that students can provide valuable input if given the opportunity take part in the evaluation of software programs. Students are very honest and will demonstrate through words and actions their likes and dislikes. The observant teacher will recognize if a child is enthusiastic or frustrated while working with programs and should seek out what it is the child likes or dislikes about a program.

When software programs have been selected to be used by those students who have been identified as high-needs learners, it is important that the students are instructed on the operational procedures of the program and that teachers constantly monitor the progress of those students as they learn with computer assisted programs. These students need to feel a sense of empowerment in their educational development and technology has provided another tool that can be used by educators in the development of such independence. Further, students need to be able to work with developmentally appropriate material and develop useful strategies to enhance their literacy learning. In words of Ellis (1974, "(T)hinking about the computer's role in education does not mean thinking about computers; it means thinking about education." (p.42)

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Using SMART Board in Foreign Language Classes

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Abstract: This descriptive study investigates the uses of SMART Board in foreign language classes. The paper first discusses how SMART Board can facilitate the teaching process. The second part is dedicated to a more detailed analysis of the various uses of SMART Board from the point of view of the student. Finally, the weaknesses of this tool will be identified. The study may show the potential value of this tool in foreign language acquisition.

Introduction

Cary Academy is a new independent school situated in a booming area of North Carolina called The Research Triangle. In this 6-12 school, teaching and learning are based on the use of technology. Each foreign language classroom is equipped with one networked computer for every student, and several SMART Boards were introduced in the classroom during the first operational year (997-98).

This paper describes and analyzes the use of SMART Board in foreign language classrooms. We will first discuss SMART Board from a teaching point of view - how SMART Board can facilitate the teaching of a foreign language. We will then look closer at the activities using SMART Board from a student's perspective -- how those activities may encourage and facilitate the learning process of a foreign language. And finally, the weaknesses of this tool will also be identified.

We will start by giving some information on SMART Board itself.

I - The Features of SMART Board

SMART Board is an interactive electronic whiteboard. This board is connected to a computer and to a projector that displays the image of a computer screen. SMART board works through a piece of software that allows the users to use SMART Board for different purposes. To enhance the board you first need to start the software and then to orient the board. Once that is done, you are ready to begin...

By projecting the computer screen onto the SMART Board the user can control all Windows applications using his finger on the board just as he would use a desktop mouse. He only needs to press the board's surface to open and close files, explore web sites on the Internet etc.

As with a regular white board, the user can take notes on SMART Board. These can be printed and/or saved like any another document.

Those are the two main features of the board. Let's see now what kind of activities Smart Board offers to foreign language instruction.

II - Activities involving SMART Board in the Foreign Language Classes

We will now analyze the activities proposed in our foreign language classes from two different points of view: that of the teacher, and that of the student.

A- Activities Which Support Teaching

SMART Board supports the teaching process of foreign languages in three main ways: 1) it helps the presentation of new linguistic and cultural elements, 2) it supports interaction with the class and 3) it promotes the teacher's organizational skills.

1) Activities Supporting the Presentation of New Linguistic and Cultural Elements

SMART Board is basically a support on which the teacher can project what he displays on his screen. The prime use of SMART Board in the foreign language classroom is to present new linguistic and cultural elements.

SMART Board allows teachers to prepare and then to present a lesson (grammar, for instance) on a Notebook document. One advantage of such a presentation on SMART Board is that the instructor can make use of the varied writing features to overwrite, underline, highlight or circle the elements he wants the students to focus on. Another advantage is that the document is typed and therefore very readable. It can also be saved and displayed at any time again.

The writing features of SMART Board also make a difference when presenting authentic documents (web sites). It enables the teacher to explore the document in depth, rather than staying at a simple presentation level. BACON/ FINNEMANN (1990) and ALLEN, BERNHARDT/ BERRY, DEMEL (1988) suggested in their studies the positive influence of authentic documents in language learning. With SMART Board the instructor can not only project a web site, he also can overwrite it to emphasize linguistic elements (vocabulary, idioms, structures etc) and specific cultural elements. SMART Board also facilitates navigation of the site. The finger-driven navigation has a tremendous advantage for foreign language classes in that it supports interaction within the classroom.

2) Activities Supporting Interaction with Students

A projection onto SMART Board is very different from a classic projection: it allows the teacher to navigate from the board. The instructor does not have to go to his computer, turn his back to the class, and be more focused on the technology than on the learning process of the students. This point is very important when using SMART Board to teach and is crucial in foreign language classes. Every foreign language teacher knows how difficult it is to have a relaxed conversation with students in the target language. The projection makes it easier to start a conversation on a topic since it allows a group to watch a document at the same time and focus on the same point of the classroom. The merit of SMART Board is that it enhances conversation: when the teacher is navigating the document from the board, he faces and interacts with the class. It allows the instructor to focus on the students' language production and conversations, not on technical issues.

SMART Board also supports communication when it is combined with a wireless keyboard. The teacher sits with the students, reading a text or a having conversation. Suddenly, new vocabulary is needed or appears in the conversation. Instead of breaking the conversation by standing up, going to the board and writing the new word, the teacher can type it with the wireless keyboard onto the SMART Board Notebook. The students do not have to worry about the vocabulary right away. At the end of the activity, the teacher can reinforce those new words by underlining, highlighting or circling important linguistic aspects (articles or prepositions) or conjugations. This document can then be printed for the students and saved for the teacher.

3) Activities Supporting Teacher Organization

Keeping track of vocabulary introduced in class is a major organizational issue in foreign language teaching, especially in more advanced classes. The feature of SMART Board that allows the teacher to save the notes written on the board during the class supports this process tremendously. It helps teachers to remember those words and promotes their reinforcement: the teacher knows exactly the new elements he has introduced and is better able to work on reinforcing each of them.

B -Activities supporting the Learning Process

1) Activities Supporting Oral Skills

PENNINGTON (1996, 10) noticed "that the computer can sometimes encourage a form of 'anti-social' behavior that amounts to working in isolation from others". A common criticism of computer use, this is especially relevant in the context of foreign language classes because we are supposed to interact as much as possible in the target language. The introduction of the projector associated with SMART Board brings this problem into a new perspective. Presented to the whole class, a web document enhances oral interaction in the classroom and opinions or ideas will be exchanged. As suggested for group activities using the computer (Abraham and Liou 1991; Chapelle, Jamieson and Park 1996), SMART Board brings people together and encourages communication.

Besides the fact that the whole class may interact regarding a particular web site, there also exists the possibility of assigning a student to navigate a site on SMART Board. The other students must guide him by giving directions according the assignment related to the specific page. Every interaction takes place in the target language.

It is also possible to have students present projects on SMART Board. They are able to present and speak about the subject without having to concentrate on the mouse. Pictures and text are shown without delay with a simple finger touch on the board to support what they have to say. This places oral production in the target language in the foreground.

2) Activities Supporting the Cognitive Process

SMART Board supports and enhances the learning process in many ways.

One basic feature of SMART Board is the possibility of overwriting any projected document. This allows the students to know exactly what they need to focus on. It helps them to not get lost and to always know exactly what the teacher wants them to select from the document. If the teacher wants to emphasize any particular structure used on a web page, he can underline it with different colors. The various overwriting possibilities presented by SMART Board (colored underline, highlighting, circling) help the students to organize the new concepts. It is a valuable visual learning tool.

SMART Board does not just *support* learning. According to PAPERT, we generally think that "in the presence of computer, cultures might change and with them people's ways of learning and thinking." (PAPERT 1987, 23). More specifically, Pennington (1996, 3) pointed out that the computer has the potential to *change* the processes involved in foreign language learning. SMART Board may have this potential too. Used to accomplish certain activities, SMART Board may enhance new kinds of learning processes. We

specifically refer here to activities requiring the use of two windows. These kinds of activities use a first window displaying an original web page in the target language, and a second window showing the teacher's instructions on this web document (what the student has to look for or to discover on the site etc.). Studies are required to support this hypothesis.

Writing a paper on French Guyana does not require the same skills as preparing a web based presentation on the same subject. We already have paper and books to write and read extensive texts. To simply reproduce a text on a web document does not make any sense at all. The web has to bring some new features to the content. One of the unique features of a web document is that it is non-linear: the use of links allows a text to have different levels.

A presentation supported by SMART Board requires the student to prepare his project according to the features of the tool that will support it. In an electronic context, this means to use links. Creating links to present a paper requires the student to organize his ideas and the content of what he has to say. It requires him to have a paper structured in different parts. The organization required by this type of presentation may encourage him to make a learning habit out of this discipline. As Chapelle and Jamieson (1996) suggested, "It seems that the type of metacognitive strategies Oxford (1990) defines - e.g., organizing, setting goals and objectives, planning for a language task - would be essential for learners working in CALL environments".

Another activity supported by SMART Board is the correction a paper by the whole class. Students can look at the papers of other students, giving them an opportunity to look at their own paper with another perspective. It may help failing students to understand better what the teacher is expecting. It is also a nice way to reward good papers.

Beside the direct or indirect general feedback that every student gets, correcting a paper on SMART Board gives everyone the possibility of working on improving language skills. Students may look for spelling mistakes, correcting them by overwriting the paper projected on the Board. This kind of correction helps students to get an eye for the language. Trying to figure out what is correct or incorrect in a language requires the students to be more aware of linguistic elements. This type of activity has impacts not only the person who produces the work but also on the group working at its improvement.

3) Activities Supporting Students' Motivation and Emulation

Students like to work on SMART Board! They are all excited about this board that you just need to touch to use. They especially love to write with their fingers, so even activities like quizzes are fun on the electronic board! They ask to be quizzed, only for the fun of writing on the board. This magic board brings true excitement in the classroom.

Many studies show how much this excitement and positive attitude is important for learning. From a hormonal point of view, the learning process cannot be started without a student's positive attitude. Vester (1994, 73) affirms that the emotional and psychological state of the student, via hormonal activity, is crucial. He explains it this way: a "negative hormonal state" provoked by stress, fear, pain ... provokes the production of the 'stress' hormone (adrenaline) which blocks the synapses activities and the ionic exchanges necessary to the mental process cannot take place. That students have to be in a "positive hormonal situation" to be able to learn. Using SMART Board gives them a positive attitude.

C - Some Problematic Aspects

The problems encountered with SMART Board are not specific to foreign language teaching but are more general problems. The technical issues we underline in this part may be specific to the use of SMART Board in an educational setting.

The first that issue teachers need to be aware of is that the orientation of the board is crucial to be able to use SMART Board properly. This has to be done carefully and nothing can be moved from at all in order to get

an optimal reaction of SMART Board when using the fingertips. Nobody should touch the projector or the cart that contains the projector. If you use a portable board, you must make sure that you have blocked the wheels. If the orientation has not be done properly or if someone has moved one of the elements involved in the projection onto SMART Board, you will waste your class time.

Another technical aspect is related to the pens of SMART Board. The place where the pens lay is electronically connected to the system so that it can recognize when a pen has been taken. This means that if you forget to put back a pen to its place, the board will interpret that you want to write with that pen, and whatever you do on the board will be written there. You will be unable to navigate if all the pens and erasers are not covering their electronic fields.

Another small issue relevant in an educational setting, especially when interacting with young students, is the quality of writing. When students are learning a language, they often cannot connect the new words to their sound system. It is important that the students be able to see a very clear spelling of the new words.

Conclusion

This analysis of SMART Board in the foreign language classroom has underlined the gains and possible problem sources for classroom use.

Our impression is that SMART Board is a very innovative and powerful support for language acquisition. First of all, it provides a bridge that allows using the features of computers without breaking *communication*, -- it even supports it. Secondly, it may enhance new kinds of learning processes, for instance when working with two windows.

On the practical side, SMART Board offers a very interesting option for bringing the Internet into every FL class. The Internet, and the access it provides to authentic documents, is the biggest revolution in foreign language teaching/learning in the last few years. SMART Board brings this interactive feature into the classroom without involving the cost of having one online computer for every student in the classroom.

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David's Story: How Technology Helped a Severely Disabled Learner Read and Write

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Abstract: This case study describes how one autistic learner became a co-researcher with university literacy instructors to investigate how hypermedia can help him develop language and literacy skills. Researchers learned that fast paced behavioral games were a detriment to learning language processes whereas books on tapes , schematic mapping software, and simulations helped the learner increase reading and writing competencies. The learner's scores doubled every six months in reading and writing.

How Can Hypermedia Help Autistic Learners?

Autism and what specifically was identified by Leo Kanner (1943) and Hans Asperger (1944) is a syndrome which has led educational specialists searching for a variety of instructional strategies to help the autistic learner acquire literacy. Due to the insular nature of this syndrome, language development and the subsequent learning of reading and writing are problematic. Language is acquired through a complex multiplicity of social stimuli. Yet, the very nature of the autistic individual prevents this necessary social interaction and the response mechanisms needed to produce language and literacy. The autistic learner, according to Kanner (1943) is alone, obsesses on sameness and has a literal mind. In this case study, literacy researchers hypothesized that a hypermedia platform might be a suitable mechanism for stimulating the development of language growth in one autistic learner (Rouet & Levonen, 1996; Spiro, Feltovitch, Jacobson, & Coulson 1991; Sprio, Coulson, Feltovich, & Anderson, 1988).

Hypermedia provides a platform which can be conducive to language growth for autistic learners. It is nonbiased, can be highly repetitive, is based upon pattern generations, and provides multiple links to senses through visual, tactile, and auditory senses. It is interactive, infinitely patient yet provides pathways for multiple ways of knowing and learning. Spiro, Feltovitch, Jacobson, and Coulson (1991) claimed that "revisiting the same materials at different times, in rearranged contexts, for different purposes and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition"(p.28). Spiro et al contend that hypertext provides a platform for cognitive flexibility and therefore allows the learner to create his own learning pathways. In addition, the flexible branching and multiplicity of information platforms provides the autistic learner avenues of learning that were heretofore not available. Multiple options such as larger print, audio and visual simulations, rebus symbols, live motion examples and multiple branching options all enhance the learner as new vocabulary and concepts link to the existing schema. In this study, one autistic learner's pathways to learning literacy are described. Past studies (Heimann, Nelson, Tjus, & Gillberg, 1995; Mykelbust, 1995; O'Conner & Hermelin, 1994; Proco, 1989; Prizant, 1996) of autistic learners describe and document the autistic learner's acquisition of word recognition alone. However, no studies systematically explain the acquisition of processes involved in reading comprehension, of retellings, and of story and information writing. This is the story of one autistic learner's journey into hypermedia and increased literacy acquisition.

Stumbling Blocks to Literacy and Why Hypermedia May Free this Roadblock

Reading and writing is a social phenomena based initially on the development of the speaking and listening processes already acquired through social interactions—talking and listening to others. However, if these connections are never firmly acquired as they are not in the autistic learner, then how

can reading and writing proceed? Reading is the recognition of a writer's message—it is listening to that writer's voice. Writing is the connection in writing to an abstract audience—to those unknown or known audiences. In addition, the abstract symbol system of writing and reading adds an additional confounding variable. Because autistic learners are inward and do not connect socially, it is very difficult for them to learn to read and write (Frith, 1989; Myklebust, 1995; Prizant, 1996; Sigman, Yirmiya, Capps, 1995). However, if they can begin to connect their wonderings to information that is available over hypermedia which is presented with a multiplicity of presentations both audio and visual, then how can this literacy acquisition occur? Most of the writing produced over the internet is information—not narrative story. Fact laden information is presented without feelings and abstract beliefs and thus, might be a more connective process for autistic learners. The autistic learner according to researchers (Grandin, 1995; Happe & Frith, 1995; and Harris, 1995; Tager-Flusberg, 1996) might be able to read and comprehend hypermedia and internet platforms far more effectively than reading books and stories. Thus, hypermedia and internet learning may be an avenue that is a perfect platform for the autistic learner who is grounded in repetitiveness, rigidity, and singlemindedness.

The Study

A year of data were collected from video taping, journal notes, interviews with teachers and the parents, test scores and student artifacts of reading and writing samples. David, an eleven year old boy, came to our office every week for one to two hour sessions. The purpose of the study was to explore his literacy growth through a hypermedia environment. He was asked to be the scientist along with us and together we explored software that would help him grow in literacy and learn important information also. Thus, David became a co-investigator with us and was very aware that we were investigating software that would enable him to advance his knowledge in many fields of learning.

Initially, he brought in software that he had at home. These were games that he played. He proudly showed us the components of each game and how he played the game. He was never able with these platforms to tell us the main purpose, to predict, or explain what concepts he had gained. These games were all behavioral in nature; to David, trial and error was the main strategy; and it never seemed to bother him if he won or not. However, we did notice that he used the characters' names of his "game" software as he wrote his initial stories on Story Weaver (MECC). As a result, these first stories were very disjointed with names attached to actions that did not make sense.

However, they did make an impression on him. It is interesting to note that David's first stories used characters and actions that he learned from these game formats but he was never able to make real sense of them as he was later able to do from retellings of CDROM talking books. For example, he drew a picture of a stage and actors and then wrote, "Spy Fox saved Mr. Othery with his toothbrush. He had a steel door and his toothbrush was on the steel door on the handle. Then those bad crabs were coming after him." With much of the game platform, David viewed the isolated parts, but never connected the whole.

My reflections from my journal were as follows.

> With this software, David, responds but seemingly without thinking why. He also doesn't seem to have a strategy as he tries one avenue, and then another. The episodes of these software pieces are very short, very reactive, and not enduring. For example, David takes the red car through a series of adventures where he must choose one pathway or another. Depending upon his decision for pathways, his car ends in a ditch or on a road to another adventure. Quick actions and reactions are necessary. As I sat and asked him questions, David was never able to tell me what he was really doing, what was the point of this game, or how it was played. He had many isolated reactions and comments, 'Look!', 'Oh!' 'Get him!' That was it. There was never an explanation on David's part. He never questioned why or tried to compare it to something in his own life or other learning. However, through all this, he was engaged.

However, due to the rapid sound byte platform of these games, once we shifted to more informational text, to talking books on CDROM and to writing and creating stories, these platforms were slow for David. At first he didn't have the attention span to sit and create a story, to read through a book,

or to discuss what he was learning and the connections that it had to his life. Initially, his reactions were only one or two words, his attention was very short, and his follow through and connections to other learning were non-existent. However, we persisted.

Talking Books on CDROM

The first books that we introduced to David were folk tales. We chose these because folk tales are formulaic, relate a story which has a moral or main point that is blatant and characters are flat and stereotypic. David is also trying to sort out what is true and what is not true. And so the exaggerations used in folk tales are blatant enough that David began to understand the exaggerations as being untrue. When reading through Pecos Bill, Paul Bunyan and Johnny Appleseed David's first reads were quick and with no discussion. He only wanted to listen to the sound reading. We had to scaffold heavily to get him to retell any of the story. He chose a small part to retell and used only one sentence.

Examples:

"'bout a boy who falls out of a wagon." (Pecos Bill)

"It's a big man." (Paul Bunyan)

"Johnny planted seeds." (Johnny Appleseed)

Building Schema

At this point, we introduced the software piece called *Inspiration* which allows children to build schema of story through pictures, words, and sentences. Then it will transform the map into a linear outline form if asked. However, this schematic platform greatly helped David to begin to understand how a story can develop.

David's first map of Johnny Appleseed had the following words and pictures: Johnny, appleseed, traveled, planted, house. He drew a picture of Johnny, the seed, the house and trees. Compare this to three months later (May) when he wrote the following with *Inspiration* and illustrated it. "Paul Bunyan. When he was a baby he was so big that he had a cradle that rocked him by floating on the water. When the cradle rocked it made big waves. The waves crashed onto the land and into houses. People were angry." During the reading of this story David asked us to write the following words; houses, waves, grew, baby, cradle, rocked. These were the words that he incorporated into his story. It should be noted that David's handwriting is very labored and difficult to read. Thus, through writing on the computer, David is better able to read and write his own words.

During the first four months, we worked with talking books on CDROM, with *StoryWeaver*, and with Inspiration. During the fall semester, we continued those platforms, but a new CDROM which became extremely successful with David. Edmark has published thematic areas which allows students a virtual reality of oceans, pyramids, rainforest, and neighborhoods. Because of the perseverance of the autistic learner, David has become obsessed with mummies, pyramids, and treasures. Thus, the software, in addition, to books (Aliki, 1979) with explicit diagrams of pyramids, drawings, writings expanded his study and readings of ancient Egypt.

In addition, to reading, writing, and investigating the Egyptian culture, David has also begun to investigate his own feelings and ask questions. "How is his God different from the Egyptian gods?" "What will happen to him when he dies?" "Will he be a mummy, too?" Of particular interest to him were the beliefs of passing into heaven or hell. In Egypt he learned that the two biggest sins were to build a dam and to harm or kill a person. David talked about the things that bad boys did and the things that good boys did in comparison. He has very literal reasoning regarding these rules. However, through comparisons, he is learning that different people do believe different things and that is acceptable. They are just different from him.

David's mother is a wonderful mother and tries to contextual all David's learning for him. She also believes in the importance of experiences that can help David learn. She provides trips and visits to special events. Along with these activities, she builds learning environments for David like collecting artifacts, books, pictures, and brochures. Each time David comes into our office, he brings something to talk about. Last summer the family went to Galveston and collected shells. David's mother helped him classify his shells and mount them in a special box with labels. He brought these to me and we digitized the pictures and created a story through Inspiration.

David at Galveston

> Last summer David went to the beach in Galveston. David collected many shells. Some were very little and some were big. Some were pink, some were gray and some were white. Some still had animals in them. David likes to collect shells.

These stories are language experience stories for him and provide practice each time for reading and writing. He takes them home and reads them to his father and mother. He also takes them to school to read them to his class.

Assessment Results

In addition to the stories that David reads and writes each time, the Woodcock Johnson Reading Mastery Test was administered in February and May to help us see the growth that he made when he is compared to a norming group. Because the norm group comparisons are meaningless (they only tell us that he is below his age norming group) we will instead look at raw data for qualitative differences.

The pretest word identification (words in isolation) David's score grew from 26 to 31. However, word comprehension and passage comprehension nearly doubled. Word comprehension grew from 12 to 20 and passage comprehension grew from 10 to 18. David learned that words make sense and so he always looks first for meaning before he attacks a passage. These scores also indicate how important contextual learning is for his literacy growth. Words in isolation mean very little to him. The interesting subtest was the word attack subtest which is a test of pronunciation of nonwords. In both the pre and post tests his score remained zero. On the pretest he listened and when the explanation told him that these were not really words, he responded, "I can't read those. They are not words." (He definitely is smarter than we are!) On the post test he took each word and tried to make a real word out of it because he know that reading and words always make sense. The words he chose were orthographic similarities. (din as desert; ig as log; dat as did; tay as tie). David is secure with about a 200 word high frequency count, however. And his use of rhyme is improving with the constant work of onset and rime each time as he builds a word family word wall.

Probably the most significant growth has been with his writing. At the first of the year, he was unable to develop any story structure at all. His stories were only words. Now, he is able to think in terms of cause and effect and outcomes. He summarizes and paraphrases. His stories are coherent and full of meaning although lacking in rich detail.

Discussion

For this study we've drawn upon the theoretical structure of Piaget, Vygotsky, and Werner. From Piaget we know that scheme is what is repeatable and generalizable. The hypermedia platform offers David unlimited repetition, the schema to build a structure for story and information through main ideas and details, and the links to areas that he knows and wants to know more about. Through simulations of pictures, sound voice, and motion, David is shown representations that are real to him. Vygotskian theory would indicate that hypermedia represents a platform that can scaffold learning within his zone of proximal development as well as linking multiple ways of representing thought connections. Werner would argue that hypermedia represents the ability to represent shifting points of view and concrete relatedness that will enable the autistic learner to come at learning through multiple symbolic representations.

Conclusions

David's literacy learning with the hypermedia platform grew in many dimensions. He became able to tell a story from beginning to end. Before he only would tell specific events or facts that were meaningful to him. Now he will write a story which has a focus. Before, there were many disconnected sentences with unrelated ideas even within a sentence. However, the most dramatic shift has been with David's attention to literacy growth. Initially, David would only tell me words to write. Now he chooses his words from the story he reads. He asks many questions. We talk and make connections to what he already knows. He builds ideas, examples, and connections based upon his learning. He uses the computer to gather information, to store information, to organize information, and then to write his own reflections and responses. Hypermedia is the perfect platform for his literacy growth because of the multidimensional way he can represent his own thoughts and language. Through Hypermedia David can learn and build literacy links far beyond those that are provided with only paper, pencil and books.

Through David's explorations into Hypermedia, he controls the construction of meaning in ill-structured domains by guiding himself through nonlinear, multidimensional explorations of language and learning.

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Communication Apprehension, Writing Apprehension, Introversion, and Computer-Mediated Communication Technology Use in Education: A Call for Research

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Abstract: This paper highlights the need for research that considers communication apprehension, writing apprehension, and introversion together with computer-mediated communication (CMC) technology use in the classroom. Brief overviews of the educationally-relevant aspects of communication apprehension, writing apprehension, and introversion in regards to CMC technology use in the classroom are presented. Finally, speculations on future lines of research are considered and a call is made for further scholarly inquiry.

Anxiety is a natural part of being human and rapid scientific and technological advances over the past few decades have served to increase the rate of exposure of individuals to anxiety eliciting situations (Carlson & Wright, 1993). Indeed, ever since *Time Magazine* named the computer "Man of the Year" in 1983, there has been an increasing drive for teachers to integrate computer technology in the classroom and scholars turned immediately to investigating anxiety associated with computer use. Currently, a search through an educational or psychological scholarly database can produce over a hundred articles on computer anxiety.

Recently, computer-mediated communication (CMC) technologies such as e-mail, electronic discussion groups, and videoconferencing have begun to be included in educational curriculums. As these technologies are based on the computer, computer anxiety is surely to be relevant; however, investigation into computer anxiety may only provide part of the apprehension picture (Reinsch, 1985). The use of CMC technologies is characterized by the act of communicating and thus consideration of oral and writing apprehensions is especially relevant. Therefore, in order to gain the fullest understanding of apprehension as it relates to CMC technologies in education, aversion to the task of communicating must also be researched.

This paper seeks to address the dearth of scholarly inquiry that considers communication apprehension and writing apprehension in regards to CMC technology use in education by making a call for research in this area. General overviews of the research literature relevant in educational contexts on each of the apprehensions and introversion will be presented. Next, directions for future CMC apprehension research will be discussed.

Literature Review

Communication Apprehension

Communication apprehension has its share of varied labels, such as reticence, shyness, social anxiety, unwillingness to communicate, and pre-disposition to verbal behavior (see Daly, Caughlin, & Stafford, 1997 for references). McCroskey (1978) defines it as "an individual's level of fear or anxiety associated with either real or anticipated [oral] communication with another persons or persons" (p. 192). In essence, highly communication apprehensive individuals engage in less oral communication than low communication apprehensives (McCroskey, 1978). The current construct is more a trait anxiety than a situation-based anxiety in that it is a "relatively enduring, personality-type orientation...across a wide variety of contexts" (McCroskey, 1982, p. 147). Although a portion of the anxiety is genetically based, reinforcement issues (e.g. operant conditioning, learned helplessness), and modeling effects form the bulk of the basis for the development of communication apprehension (Daly et al., 1997).

Communication apprehension has several educational correlates. For instance, communication apprehension is positively associated with classroom apprehension (Olaniran & Roach, 1994), text anxiety (Scott, Wheeless, Yates, & Randolph, 1977), and preferences for large lecture classes over small ones (McCroskey & Anderson, 1976). It is negatively related to performance on oral exams (Bettini & Robinson, 1990), motivation to study (Frymier, 1993), and positive attitudes toward school and instructional activities (Hurt & Preiss, 1978;

McCroskey & Sheahan, 1978; Scott & Wheeless, 1977b). High communication apprehension is related to a tendency for students to wait until after class to ask a question of a teacher, not raising one's hand in class, waiting for someone else to answer a question, and not borrowing notes from another student (Neer, 1990). Additionally, highly apprehensive students perceive teachers as less animated, less likely to leave impressions, less dramatic, and less friendly than low apprehensives (Anderson, 1979). Furthermore, Richmond (1997) observes that no only do quiet students learn less in school, they also tend to be absent on presentation days; sit along the sides or the rear of the classroom; quiet younger students may assert they cannot read to avoid reading aloud in class; and in group discussions quiet students will withdraw as much as possible, contribute less, make irrelevant comments, and profess agreement with the group regardless of their actual feelings.

Nevertheless, research has generally not investigated the effect of communication apprehension on actual CMC technology use in the classroom. However, research does suggest that communication apprehension does affect media use. Carlson & Wright (1993) did find a small positive relationship between communication apprehension and fear of the computer itself. Scott & Rockwell (1997) found that communication apprehension is negatively correlated with reported likelihood to use CMC technologies and strongest with those involving a high oral component. Additionally, in unpublished research, Rapp (1998) found that communication apprehension was a weak predictor of choice among CMC technologies that varied as oral or written. With communication apprehension affecting so many educational variables, it is a great weakness in the research literature that the effect of communication apprehension on CMC technology use in the classroom is not well known.

Writing Apprehension

Klopf & Cambra's (1979) research underlies the importance of examining writing apprehension as a construct separate from communication apprehension because communication apprehensive individuals are not necessarily apprehensive about writing and vice versa. Daly (1977) defines writing apprehension as a learned response by an individual to either approach or avoid writing encounters. Behaviors displayed by writers, the attitudes expressed about writing, and the actual written products can all reflect writing apprehension (Faigley, Daly, & Witte, 1981). Highly apprehensive writers learn to expect negative evaluations of their writing and can potentially find writing punishing (Faigley et al., 1981). Low expectations drive the highly apprehensive writer to avoid writing, which results in less practice in writing, which in turn results in lower evaluations of writing compared to low writing apprehensive individuals (Daly, 1977). Those low in apprehension, on the other hand, are confident in their writing skills and often enjoy writing (Faigley et al., 1981).

Research also indicates that highly writing apprehensive individuals write messages of less words, less sentences, less qualifications, and of less quality than messages written by low writing apprehensive individuals (Daly, 1977). Also, highly writing apprehensive individuals use significantly less intense language than those low in writing apprehension (Daly & Miller, 1975a). Writing apprehension has also been shown to be inversely related to measures of self-concept, self-esteem, and self-competence (Daly, 1976 as cited in Daly, 1977; McCroskey, Daly, Richmond, & Falcione, 1977).

Writing apprehensives tend to be the individuals who consistently fail to turn in compositions, who do not attend class when writing is required, and who seldom voluntarily enroll in classes in which writing is pervasive (Daly & Miller, 1975c). Daly provides evidence that not only do highly apprehensive writers write differently than low apprehensives, but that high apprehensives additionally fail to demonstrate as strong a working knowledge of writing skills as low apprehensives (Daly, 1978). Indeed, an inverse correlation exists between the construct and reported SAT-verbal scores (Daly & Miller, 1975b). Writing apprehension has also been shown to affect student satisfaction in writing courses, expectations of success in writing courses, and enjoyment of outside-of-class projects (Daly & Miller, 1975b; Scott & Wheeless, 1977a). Additionally, teachers may need to use different instructional materials for highly apprehensive writers given their different performance in writing than low apprehensives (Faigley et al., 1981).

The connection between writing apprehension and the use of CMC technologies is not clear. Very few studies have investigated the relationship between writing apprehension and CMC technologies, especially in the classroom. Moreover, the studies that do exist have produced conflicting results. Harris and Grandgenett (1992) found that writing apprehensive individuals were less likely to log on to a computer-mediated communication system than those low in apprehension. Mabrito's (1991) research suggests that CMC technology can prove to be an equalizing force to bring highly writing apprehensive individuals to the same participation level in evaluating writing as low writing apprehensive individuals. Yet, another study found that highly writing apprehensive individuals were less likely to communicate in teacher-student interactions in a computer-mediated collaborative writing environment than low writing apprehensive individuals (Hartman et al., 1991). Feenberg (1987) reports that

users in a text-based CMC conferencing system may feel very anxious about how communications written by them are received and evaluated, but at the same time will approach receiving messages from others with extreme casualness. However, a recent study found that writing apprehension was not correlated at all to likelihood to use CMC technologies (Scott & Rockwell, 1997). Rapp's (1998) research is also consistent with the finding that writing apprehension does not affect CMC technology choice, message length, or communication process satisfaction. These seemingly contradicting results highlight the need for a greater understanding of the relationship between writing apprehension and CMC technology use.

Interaction of Apprehensions

Studies that investigate interactions among apprehensions are rare in the research literature. Dobos (1995) did investigate communication apprehension, writing apprehension, and computer anxiety together, but did not explore the effects of the interactions among the different types of apprehension. Scott & Rockwell (1997) concluded that the combination of the apprehensions better predicted the use of some communication technologies, but not for all of them and Rapp's (1998) study is consistent with this finding.

One of the chief limitations of the interaction studies that have investigated apprehensions and CMC technology use is that they have concentrated on technologies that are primarily oral or written. Many recent technologies, on the other hand, increasingly blend oral and written elements. Indeed, group decision support systems and other collaborative CMC interactive environments often have oral (e.g. videoconferencing) and written communication (e.g. computer conferencing or electronic whiteboards) occurring simultaneously. As these technologies begin to make their way into schools, it will be necessary to have an understanding of the interaction effects, if any, among apprehensions in regards to such blended CMC technology use.

Introversion

Although introversion is not *per se* a communication construct, it is clearly related to communication apprehension and many researchers investigate the construct with communication apprehension (McCroskey, 1997). Introverts tend to exhibit the communication characteristics of being quiet, reflective, introspective, reserved, and subtle, whereas extroverts tend to be outgoing, sociable, lively, talkative, expressive, and enthusiastic (Jung, 1921/1971). Low communication apprehension is commonly associated with the extrovert (Meyers, McCallum, & Domingue, 1993; Richmond, McCroskey, & McCroskey, 1989). However, writing apprehension and introversion have not been investigated together in the research literature. Some research indicates little correlation between writing apprehension and other personality-type individual differences (Daly, 1977). Straus (1996) found that participation in CMC is associated with extroversion; however, other research has found that introverts and extroverts do not vary in regards to their CMC technology use (Russ, Daft, & Lengel, 1990). Also, introversion may be a predictor of CMC technology choice, but more so for technologies with a high oral component than for those with a high written component (Rapp, 1998). Thus, as introversion is often expressed by communicative behaviors and given the limited understanding of its effect on CMC technologies, investigation into introversion's relationship to communication apprehension, writing apprehension, and CMC technology use in the classroom is a salient line of research.

Speculation on Implications

Although the understanding of the effect of communication apprehension and writing apprehension on CMC technology use in the classroom is limited, it is still exciting to speculate on some potential implications of the current research. Scott & Rockwell's (1997) research revealed low to moderate negative correlations between communication apprehension and likelihood to use some CMC technologies. Likewise, Rapp (1998) found communication apprehension to be a weak predictor of CMC technology use. The presence of the computer in these instances may provide some explanation as to why the association is not as strong as one might expect. The behavior of talking through the computer may reduce the user's perceived relevancy of communication apprehension. That is, the task of interacting with the computer may take precedence over perceptions of using an oral communications channel. The act of communicating orally in a computer-mediated environment may serve to make communication seem less direct, thus reducing the effect of communication apprehension. If this is indeed the case, it is interesting to wonder why this may be so. Perhaps novelty perceptions are overriding the expected relevancy of communication apprehension. Communicative interaction that would not normally take place may be

encouraged by perceptions of novelty in regards to new CMC technologies, such as videoconferencing. Teachers could use such an effect to increase the interaction of communication apprehensive students in their classrooms and it also might increase positive attitudes toward school and learning. It must be stressed that this is speculation and by no means is it demonstrated in the research literature. However, it does highlight the greater understanding that investigation into communication apprehension and CMC technology use in the classroom can bring to the field of education.

Moreover, the preliminary findings regarding writing apprehension and CMC technology use are especially engaging. If writing apprehension is indeed shown not to be related to CMC technology use, this paradox will assuredly spur much research. As with communication apprehension, a user's perceptions of the computer may alter the individual's perceived level of writing apprehension. Generally, a keyboard is the primary mechanism by which text is entered into a computer. However, the keyboard is also used for a great deal of tasks that would not immediately be labeled as writing. If the keyboard is considered by users to simply be an interface to the computer rather than as being analogous to a pen or pencil, the user's level of writing apprehension may become less salient. Additionally, if writing apprehension is not related to CMC technology use, educators can use this to great advantage. The implication is that if a text-based CMC system is used (e.g. group decision support system or collaborative writing software), students communicating via the CMC technology will be on roughly equal footing as far as an apprehension toward communicating is concerned. Writing apprehension may not then hinder participation, thus increasing the likelihood of efficient and valuable contributions to the discussion. Also, teachers would be able to judge an absence of communication as more of an indication of less grasp of the material than a reluctance to communicate due to an anxiety of writing. These tantalizing speculations indicate the immediate need for a greater understanding of writing apprehension's relationship to CMC technology use in the classroom.

Furthermore, the construct of introversion may also aid in giving understanding to the relationship between apprehensions and CMC technology use in educational contexts. Consideration of the differences between introverted and extroverted behaviors may begin to provide some explanation to the conflicting findings of several of the studies that took introversion into account when investigating CMC technology use. Those high in extroversion would logically be expected to engage in and desire more social activities than introverts. Therefore, extroverts may be more likely to engage in CMC technologies that they perceive to meet an acceptable degree of sociability. Oral-based CMC technologies would probably fit this criteria, but not written-based CMC technologies because CMC technologies with a high written component are characterized by a less temporally adjacent response, thus potentially limiting the degree of perceptions of sociability by extroverts. For teachers, this could imply that using CMC technologies with high written components may make interaction differences prompted by introversion-extroversion less of a factor than if oral-based CMC technologies were to be used. Again, whether this is the case is not known, but researchers should not exclude introversion from investigation into the relationship between apprehensions and CMC technology use in education.

This paper has provided a brief overview of the relationship of communication apprehension, writing apprehension, and introversion to CMC technologies in educational contexts. Additionally, a few speculations designed to highlight the limitations of the current research were put forth and discussed. As technology and especially CMC technologies become more and more pervasive in educational institutions, the need for a strong theoretical and practical understanding of the relationship between apprehensions and CMC technologies in education is paramount. The potential rewards for learning, classroom interaction, and teaching necessarily demand scholars' attention to this exciting area.

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TECHNO-POETRY: ENHANCING POETRY WRITING IN METHODS COURSES THROUGH TECHNOLOGY

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This paper describes the outcome of an innovative mentoring program at Iowa State University that paired technology faculty with methods faculty to form partnerships that modeled technology integration for K-6 preservice teachers. As a result of the partnership within a reading/language arts course, both faculty members concluded that even topics in seemingly juxtaposition such as poetry and technology could provide successful models of integration. While many have made worthy technological applications within poetry instruction, most of these applications are related to incorporating visual presentations with poetry such as laserdisk technology and multimedia projects or they use electronic postings, teleconferencing, and distance education to revise and edit poetry. These applications treat technology as an addition rather than a true partner that reaches into the actual writing of poetry. Conversely, this paper describes the creation of some useful applications for enhancing poetry writing through technology for elementary students.

Everyday Learning with the Tools of Tomorrow: Exploring Web Based Literacy Projects through the Eyes of a Third-Grade Classroom

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Abstract: This paper details the integration of technology tools into a third-grade web based literacy project. The project included 13 students at the beginning of the school year possessing a wide range of technology exposure and reading experience levels. The students were provided an opportunity to work in small groups, reading works by a selected children's author, researching biographical data and exploring the writer's style and use of conventions of literary works such as characterization, plot and setting. Included in the project were authentic purposes for writing; research on the web and traditional sources; cooperative and collaborative learning opportunities; and planning, designing and creating finished products in a multi-media presentation.

Introduction

Today's student will be entering a work world which holds differing expectations from those of the past. This modern work world will require them to know more than how to navigate technology tools to achieve a desired and predetermined effect. They will use technology as a tool to express and share their knowledge and findings. Use of the traditional linear curriculum model assumes that students will enter the learning arena at a specified point with a benchmarked knowledge base and a prescribed set of skills, proceed through a set course, and emerge at the other end "educated". This model, which evolved from the industrial age, is becoming obsolete as we progress further into the age of information. It must be replaced by a model which addresses real world expectations, allowing students to learn through an integrated approach with opportunities to work collaboratively and cooperatively as well as individually. The new model of education must include practical, authentic use of technology as a tool for research and presentation. However, according to Owston (1997), we cannot expect the use of technology tools to revolutionize education on their own. Instead, the key to the impact of technology, and in particular to the use of the Web, is how *effectively* it is used in the classroom.

Foundation: Tools

Today's children, in many cases, continue to be taught with yesterday's tools, a method that could leave them unprepared for our rapidly evolving technological society. An emphasis on learning predetermined content in isolation would more effectively be replaced by an emphasis on learning to think and learning to learn. Haymore, Sandholtz, Ringstaff and Dwyer (1997) identify this as a phenomenon in American schools spawned by accountability systems that relied heavily on raising standardized test scores. These programs for change became commonplace in the 1980s and seem to be on the rise once again. Today, leaders in our nation measure our children against each other and against the children of other nations with norm-referenced scores. As society clamors for higher test scores, schools become more adept at turning students into "better test-takers, but at a terrible cost" (p. 12). Their ability to perform complex tasks suffers as the emphasis in the classroom shifts to "drill and practice of the kinds of skills and disjointed facts" (p. 12) targeted in standardized and norm-referenced tests. With this in mind,

we must not lose sight of the fact that today's students must be able to think critically about the information presented to them, analyze, dissect and discover new ways to apply the information and use it as a stepping stone to further learning. Furthermore, they must be exposed to the many technological advances which will advance their endeavors--advances such as the Internet and presentation tools. Rather than being taught about technology, they must learn to use technology in everyday learning. The emphasis must shift from instruction in how to use technology tools, to instruction that uses technology as a tool. In the former model, technology is an object of study. It is operation based and important to understanding the tool, but the learning is superficial. In the latter, technology tools are the means to an end--they are incorporated with learning in a fashion similar to utilizing a chalkboard, pencil and encyclopedia. The learning that takes place incorporates complex thinking skills such as analysis and synthesis because it is application based, more advanced and thus more complicated.

Foundation: Environment

Classroom environments have a large part to play in how technology is incorporated in the curriculum. A traditional direct instruction model, which was thought to be effective in delivering predetermined content in isolation, does not prepare students totally for a society that requires a great deal of synergy and non-linear productivity. Our classrooms must, therefore, reflect this modern model of society. To do this, we must realize a shift in our traditional concept of the classroom and foster *A.C.T.I.V.E.* (Grabe & Grabe, 1998) environments with opportunities for *Active* and *Cooperative* learning. Grabe and Grabe adopted the acronym *A.C.T.I.V.E.* to describe the ideal setting for a technology-rich classroom. This environment is *Active, Cooperative, Theme-Based, Integrated, Versatile* and *Effective*. An *Active* and *Cooperative* environment reflects the shift from competitive learning to cooperative learning which allows children to draw on peers as resources and as sounding boards for formulating, defining and defending new learning. According to Crook (1998), these learning situations are most successful when three criteria are met: (1) an existing "communal purpose," (2) an ample supply of resources and (3) previously established interpersonal relationships (p. 241). Grabe and Grabe (1998) maintain that the learning must be *Theme-Based* to allow critical connections to the real world. These theme-based projects must be *Integrated* across the subjects to teach skills in meaningful contexts rather than in isolation. The environment must be *Versatile* to accommodate many skill levels and interests. Finally, *Evaluation* must be based on progress, products and effort (p. 23). A teacher and student designed rubric such as the one implemented in this project meets the evaluation criteria necessary for this type of environment.

Shifting Roles

A change in environment will necessarily require a change in roles. Haymore, et al (1997) assert the premise that roles must reflect the modern workplace "where problems are solved through conversation, inquiry, trial and error, and constant comparison of one approximate solution against another." (p. 13). In this type of environment, teachers will step down from the podium to relinquish their role as "lecturer" in favor of the role of "coach". There will be a shift from teachers as "lesson planners" to teachers as "instructional designers". As such, teachers will focus on selecting activities and providing materials. The teacher will introduce the activity and assign a task set in a meaningful context with clear goals. The teacher's goal is to facilitate the students' work by making connections between observations made by the students and associated principles or theories. The teacher will interact with students in a variety of situations: whole-group, small group and one-on-one. Overall, there will be a shift from large group direct instruction to small group instruction, which addresses the particular needs of targeted students. Students will become active participants, constructing knowledge and taking a decision-making role in their education. In this new role, there is a shift in the child's acquisition of knowledge from primarily verbal content to an integration of visual and auditory elements. The student is no longer a passive learner taking in all that is delivered and reflecting that same learning in much the way it was delivered. In this modern model, the traditional "cookie-cutter" students are transformed into active learners who are inquirers and members of a production team, each with an important, often unique role in the total learning experience of class members.

Scaffolding

When children are given support to explore how technology works, they are encouraged to realize their technological potential. They become cognizant of their ability to impact technological products and to express

themselves through technological tools (Stables, 1997). The WebQuest as developed by Bernie Dodge (1997b) is an excellent scaffolding tool for young technologists with an emerging role as active participants and decision-makers. "A WebQuest is an inquiry-oriented activity in which most or all of the information used by the learner is drawn from the web" (Dodge, 1998). This information may be supplemented with traditional information sources (e.g. trade books, encyclopedia, dictionary). It is designed to assist the learner in focusing on and using the information provided by the quest rather than looking for the information. This information is in the form of links to web pages which have been previewed by the teacher or WebQuest designer to ensure their relevance and value to the task at hand. The links take the learner to the targeted information, thus relieving him or her of the burden of searching and sorting through the myriad of information available on the web. This method is all the more attractive and effective when considering the very real possibility that children will be sorting through information which is objectionable or of little value. The WebQuest is a way of narrowing the available resources in much the way a teacher would narrow library holdings by previewing relevant resources and reserving them for the class.

"The WebQuest is designed to support learners' thinking at the levels of analysis, synthesis, and evaluation" (Dodge, 1998). This is accomplished by offering opportunities which allow the learners to make choices and take control of their project while providing enough scaffolding to ensure success and a sense of direction. In a longer term WebQuest, students might be required to use many higher level thinking skills as they: compare similarities and differences, classify by attribute, induce or deduce by inferring generalizations, analyze errors, construct support (proof), abstract key ideas, and analyze differing perspectives (Dodge, 1997a). These are all skills to consider and build in when developing the "process" portion of the WebQuest.

WebQuests may be short- or long-term projects. In a short-term project, the instructional goal is knowledge acquisition and integration. "At the end . . . a learner will have grappled with a significant amount of new information and made sense of it" (Dodge, 1997a). This type of WebQuest is designed for completion in one to three class periods. The instructional goal of a longer term WebQuest is to extend and refine knowledge. "After completing a longer term WebQuest, a learner would have analyzed a body of knowledge deeply, transformed it in some way, and demonstrated an understanding of the material by creating something that others can respond to, on-line or off-" (Dodge, 1997a). This type of WebQuest will typically take between one week and a month in a classroom setting. The WebQuest used for these third-grade students, *WebQuest: Amnesia,* was a longer term WebQuest.

A typical WebQuest is found on a web page, but with newer versions of word processing software which support web links, a web page is not essential to the task. A WebQuest includes an introduction that explains what the WebQuest is about, orients the learners as to what information will be presented, and clearly describes the steps to be taken. The WebQuest includes information that will let the learner know the exact process needed in order to accomplish the task. Additionally, learning advice and information resources in the form of links should be provided as well as resources not found on the web. Evaluation of the students' work should be able to measure the results of the WebQuest. A rubric devised by the teacher in the design phase of the WebQuest or a rubric devised by the teacher and learners in a collaborative context are authentic methods of evaluation. The WebQuest concludes with a method of sharing the learners' product as evidence of the learning gained by the students. This closure activity serves to remind the learners about the learning that took place and encourage extension of the experience into other domains. Sharing the product may be accomplished in a multi-media presentation to peers and adults and can be loaded on the web page.

Action: Literacy Project

El-Hindi (1998) asserts that today, literacy is more than reading and writing, it includes the ability to "make sense of and navigate through several forms of information including images, sounds, animation, and ongoing discussion groups" (p. 694). This literacy project focused on El-Hindi's definition and incorporated the use of a WebQuest. It was conducted with a third-grade class of 13 students in a suburban "Chapter One" (as determined by low income) elementary school. These students included one child identified as "gifted," three children served by the school's speech therapy program, one child being tested for learning disabilities and one identified with Attention Deficit Disorder. Of these students, there were three African American, five boys and eight girls.

The introduction to the WebQuest stated that a favorite children's author was stricken with amnesia and the task before the learners was to help the author regain his or her memory (Foster, 1998). Children formed groups that

varied in size from two to four members and selected an author from the choices provided on the WebQuest. The first task was to select job roles and set tasks for the week. Next, the students brainstormed possible avenues that would help their author to regain his or her lost memory. Strategies employed by the student groups included researching biographical information and reading the author's work to determine the writer's style. Additionally, the group constructed a synopsis of each story focusing on plot, theme, characterization and literary elements.

Children learned to use the links on the WebQuest page to research their author's biographical data and the books he or she wrote. They wrote letters to the school librarian and the teacher to enlist their aid in gathering trade books. They accessed the computerized card catalog in the library to locate and secure resources. They created advertising fliers to describe their mission and in the process learned many computer skills including retrieving an image from the web and using word processing software. These fliers were then loaded on the web page with the WebQuest. As the students collected data, they began to design HyperStudio cards as evidence of their learning. An example card was then used in a group critique session allowing the children to consider elements such as color, contrast, content and effectiveness. Throughout the project, the students kept a daily learning log describing their accomplishments, problems and solutions and plans for the next day. Some of their log entries were in the form of e-mail messages to Dr. Snider, see [Figure 1]. By e-mailing Dr. Snider, the students were afforded an opportunity for authentic electronic communication and were provided with another expert source of support. All four groups were able to create a HyperStudio card for their author. As a class, they decided to keep this project as an ongoing experience, adding to and refining their cards with specified deadlines for various elements of their products. The HyperStudio stacks were loaded on the *WebQuest: Amnesia* page and shared with other classes in the school.

An important part of the evaluation process calls for the instructors to reflect on the effectiveness of the project and use this to plan future WebQuests. As part of the evaluation process, the instructors considered lessons learned in this first attempt at a WebQuest. Prior knowledge of the specific multi-media program used in this project emerged as the primary area of concern. These children had never been exposed to HyperStudio and needed an opportunity to play with the tool as a way of familiarizing and fulfilling a desire to explore. Although this aspect had not been built into the project by design, the children took advantage of the student-directed environment to undertake these explorations. These explorations, at first, seemed to be time-consuming, off-task behavior; however, they proved valuable to the children's understanding of the tools and built foundational skills which were utilized and further developed as the project unfolded.

Figure 1: Authentic purposes for writing were included in the project. Children kept Dr. Snider apprised of their progress. (The student's original composition was retained.)

Due to the children's unfamiliarity with the tools and the fact that this was a beginning effort in the use of the web as a scaffold for constructing student projects, expectations were somewhat flexible. Therefore, rather than following WebQuest design steps exactly as designed, the instructors did not initially establish a rubric for the children. Instead, students were given an opportunity to use HyperStudio and generate the initial card prior to establishing a rubric for the product. This allowed the children to familiarize themselves with the options and limitations of the software and gave them a more informed understanding of the scope of the WebQuest project. This greater understanding then allowed them to be active participants in generating a rubric with reasonable expectations, see [Figure 2].

Figure 2: Learners actively participated in developing a rubric with reasonable expectations.

In order to help students remain focused on the project goals and minimize time wasted on narrow objectives and off-task behaviors, deadlines were imposed for various written assignments. These assignments were in addition to the HyperStudio cards, (e.g.: summaries, character and story webs, a log of titles with their main ideas). Daily learning log entries helped the students structure their goals and reflect on their progress. These entries also provided evidence of understanding and pointed to possible teaching points which needed to be addressed either individually or in a group setting. Additionally, weekly teacher-student group conferences permitted guidance and further scaffolding by a "more experienced other" and helped the teacher to establish a timeline for completion of the specific tasks inherent in the project.

In addition to supporting developing technology skills, encouraging the use of various multi-media programs, and helping students to set project goals and evaluate a finished project, designers should consider the roles of student and teacher and how these can be facilitated most effectively. Reflection on the scaffolding provided to the children in the form of links and supplemental sources as well as the clarity and effectiveness of the goals presented in the WebQuest is paramount. All of these factors should be considered in order for an evaluation of the WebQuest to be an effective tool for planning future projects.

Next Steps

Teachers and curriculum materials designers may want to further explore web-based literacy projects by researching examples of WebQuests (see Dodge 1997). Many fine examples can be found by accessing this web page and following the links attached to this page.

Once the designer has exposure to examples and an understanding of the goals and various elements of a good WebQuest, a unit of study should be identified. When choosing goals for the project, special attention should be given to aligning the WebQuest with established curriculum scope and sequence guidelines. Student interest can also be used as a determining factor in the formulation of a unit of study. Additionally, the designer will need to locate the necessary software and hardware to ensure that the WebQuest is feasible. Finally, the designer will use search engines to locate and collect relevant websites for use in the project. By following these next steps and keeping in mind the lessons learned through this first attempt at a WebQuest, teachers can help their students walk further down the path of the information age equipped with the tools necessary for today and provide a foundation for the crucial skills needed for tomorrow.

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Using Semantic Networking Tools to Teach Reading

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Abstract: Active thinking and learning supports the interactive view of reading comprehension where the role of the reader's background in understanding the text is acknowledged. In this view, teachers can build on students' existing schemata to support comprehension. This paper presents a successful method for teaching reading comprehension through the use of *Inspiration*, a semantic networking program.

Introduction

Every year thousands of children fail to learn how to read or they read at such an inadequate level that they are functionally illiterate. The inability to read is detrimental to children in today's modern society as it hinders their intellectual and educational growth. Children who do not read well in the first, second, and third grades are likely to struggle with reading throughout their lives.

The problems associated with having limited reading skills in the United States have been well documented. Children who have difficulty learning to read do less well in other subjects, have lower self esteem, pose greater discipline problems in school, and are less likely to complete a high school education. For adults, limited reading ability is correlated with unemployment, crime and lack of civic awareness, poor health and other problems.

On August, 27, 1996, President Clinton announced *The "America Reads" Challenge*, a major initiative to ensure that all children can read independently and well by third grade. However, nationally 40 percent6 of fourth graders do not meet the basic level on the National Assessment of Educational Progress (Read Well and Independently, 1997).

Innovative programs in reading, as well as other content areas, are demonstrating that technology can facilitate new ways of teaching reading and learning challenging content. Computers have provided many opportunities to enrich instructional activities in reading. The best use of technology for a reading program is through software that promotes interactivity and builds on the premise that reading is a constructivist activity.

The constructivist view of literacy emphasizes that learners actively create meaning. Reading becomes a meaning making and meaning using process. Meaning is constructed through the interaction of the student and the text. This view acknowledges the role of the reader's background in understanding the test (Burns, Roe, & Elimore, 1996). The proficient reader validates comprehension by decoding important text and by using prior knowledge.

These readers build mental models or diagrams as they read. The comprehension process involves the reader in the active construction of meaning by making connections between what is known and what is new. This meaning making specifically engages learners in relating ideas to what they already know (Barchers, 1998).

Concept mapping is a reading strategy that requires learners to draw visual maps of concepts connected to each other via lines. Taking the form of graphic organizers, concept maps give students information relative to the content material encountered and to support the knowledge-building process (Brozo & Simpson, 1995). Graphic organizers are a diagram or scheme for show3ing relationships among words and concepts. In a graphic organizer, a superordinate concept is identified with coordinate concepts and subordinate concepts arranged in an appropriate hierarchy. There are a number of paper–and-pencil methods for representing these maps that depict semantic structure among concepts (Barchers, 1998).

Active thinking and learning supports the interactive view of reading comprehension where the role of the reader's background in understanding the text is acknowledged. In this view, teachers can build on students' existing schemata to support comprehension. Students select the information to be learned, commit information into memory, make connections among ideas, and integrate new ideas with existing knowledge (Barchers, 1998).

However, recently several computer-based concept mapping tools or semantic networking tools have become available. Semantic networking programs are computer-based visualizing tools for developing representations of the semantic networks in memory. These tools enable learners to identify the important ideas or concepts and interrelate those ideas in multidimensional networks of concepts by labeling the relationships between the ideas (Jonassen, Peck, & Wilson, 1999).

Inspiration for Windows has become available as a powerful mind tool for organizing and integrating ideas. It is one of the most foremost visual thinking and learning tools available. In *Inspiration,* students can create a picture of their ideas or concepts in the form of a diagram. Thinking and learning becomes an active rather than passive process (Inspiration User Manual, 1997).

In *Inspiratio,n,* many kinds of visual diagrams such as concept maps, idea maps, webs, storyboards, and outlines, can be created. It has two views or environments: Diagram view and Outline view. As students work, they can keep track of their ideas.

As part of a strategy to teach elementary preservice teachers how to teach reading comprehension to children, I have integrated I*nspiration* into assignments for a field-based initial reading course. I have found that this software offers new opportunities for children and teachers to be creative and to invent new means of expression, and to tackle more interesting and complex readings. This presentation will show how elementary preservice teachers are using this software to design reading lessons for students and how they integrate the software into their lessons.

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Basing Reading Problem Assessment on the Computer: A Information Processing Approach

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Abstract: Computer Managed Reading Programs have become more common in the primary grades nationally. Reading instructors can use these programs to track curricular, and extra-curricular reading activity, track individual student progress, and compile group performance data for a wide range of children's literature. This article considers the benefits and potential pitfalls of CMRPs from a pragmatic and psychological standpoint. The effective use of CMRPs can provide lasting benefits, both from a cognitive-developmental and a motivational theoretical perspective.

What is a CMRP?

Computer Managed Reading Programs, hereafter referred to as CMRPs, refer to a family of software that is available to elementary school teachers which assists them in the tracking of students' reading progress of both in-class and extra-curricular reading materials. A commonly used CMRP is Accelerated Reader. This and similar programs provide multiple-choice comprehension tests that students take upon completing a piece of literature. Test items assess both literal and inferential comprehension. The software supports inclusion into the curriculum of hundreds of examples of quality children's literature. The software also tracks children's progress and the progress of the class as a whole. Students' who are falling behind predetermined norms can also be tracked and flagged by most programs. CMRPs also provide instructors with the option of expanding the literature base and adding teacher-made comprehension tests.

Uses and Benefits of CMRPs

School districts across the country are purchasing computer managed reading programs. There are tremendous benefits in instruction and assessment when these programs are properly implemented. What follows is a discussion of the psychoeducationl benefits of the addition of CMRPs to the regular classroom.

Instructional Benefits

Research by Stanovich and Cunningham (1992) has demonstrated that when children read texts beyond what is required by the curriculum, the results are long-standing cognitive gains. CMRPs provide teachers with easy access to individual silent reading comprehension of those books that students read beyond the curriculum. This integral part of a child's reading development is often difficult to assess and is accomplished by the student taking a short computer-administered comprehension test given by the CMRP. CMRPs are useful for other types of reading as well. Instructors

can use these programs to assess listening and guided reading comprehension. An instructor may also wish to program the CMRP with tests from curricular-based materials. Whether an instructor only tracks silent reading comprehension or wishes to track a large variety of reading comprehension-based activities, a well designed CMRP will track and compile a variety of data.

CMRPs are designed to give the instructors compiled and individual student data that can aid in the design of the curriculum and better meet individual student needs. Class composite reading level averages, individual book lists, and comprehension scores are several pieces of information that are at the fingertips of an instructor using a CMRP.

Though a CMRP is easy to operate and data is readily available, there is an important element that must be considered for it to be successful in the classroom. An instructor must first determine the reading ability level of the student and her/his zone of proximal development. The Zone of Proximal Development (Vygotsky, 1986) is a concept central to Vygotsky's socio-cultural theory of cognitive development. It refers to the difference in performance at any task between what a child can do while working independently vs. what a child can do with the assistance of a competent peer or adult. Texts presented at the upper end of the zone of proximal development are challenging to the child but are still within grasp.

Reading materials should be selected for each child within her/his zone of proximal development, preferably at the upper end. CMRPs can help identify, based on a student's past performance, texts that are developmentally appropriate and optimally challenging. CMPRs provide teachers with information on texts difficulty and student comprehension performance. Children will score at ceiling (100%) on materials that are at the low end of their zone of proximal development. Texts that result in comprehension scores between 50% and 80% are at the high end of a student's zone and thus are optimally challenging for the reader. Students can then be presented with texts at this difficulty level until comprehension performance is as ceiling.

Better Student Monitoring: Resulting Motivational Benefits

CMRPs make it extremely easy for the teacher to keep abreast of a large number of indicators of students' progress with a minimum of effort. Furthermore, these program make it easy for instructors to take into account the type of language comprehension, whether independent reading, reading with a peer, or listening comprehension. More advanced readers require more independent reading than beginners. Again, CMRPs allow for the tracking of all types of reading outcomes.

A CMRP is useful in monitoring a broad range of ability levels. Most elementary classrooms contain a broad range of ability levels, especially with the emphasis today on inclusion. A classroom instructor can tailor lessons to fit the needs of various clusters of students; the CMRP can be used to monitor each of these groups. Therefore, the students benefit from instruction customized to their needs, and the instructor benefits from the greater ease of assessment. The data generated by the CMRP can help identify students' independent and instructional reading levels without the need of administering a time-consuming individual reading assessment.

An understanding of student motivation and factors affecting it is crucial for the teacher. Students in the regular classroom can usually be classified as having either performance goals or learning goals (Brophy, 1987; Dweck, 1986). Students with performance goals seek to outperform their peers and can have excellent grades, regardless of actual achievement. When an emphasis is placed on competition in the classroom or preparing students for standardized tests, performance goals tend to emerge in students. Learning goals, on the other hand, involve students wishing to learn for its own sake. This intrinsic motivation is encouraged by the teacher who emphasizes learning as its own reward and adopts a mastery orientation. Clearly, the learning goal orientation is in the students best interest.

CMRPs can help determine reading motivation and can track student achievement toward individual and classroom goals. In programs such as Accelerated Reader, developmental ratings are assigned to each book as well as point values based on the developmental rating and book length. One is typically assigned to first grade books while ten corresponds to books at the high school level. Students earn points based on the percentage correct on the comprehension test multiplied by the point value of the book. For instance, if a student achieves 80% (.8) correct on a 5 point book, the points earned would be 4. Thus, students are reinforced for attempting more difficult books. It is important for instructors to consider book difficulty along with comprehension scores. Students, when given a choice, who consistently choose easier books are more likely to have a performance orientation. Those consistently choosing more challenging book tend to have a learning orientation. Teachers can encourage learning goals by discouraging competition between students.

Implementation in the Classroom: Potential Pitfalls.

There are factors that limit the benefits of CMRPs. Improper implementation of a CMRP is as good as not having one at all. For instance, instructors must stay current in tracking data. Recent data, that may show a child is struggling, will not surface in a report of a child's yearly compiled record because previous high scores will "drown out" more recent low scores. Fortunately, more advanced CMRPs will track a variety of data and highlight any extreme changes in performance.

Access to computers may also pose a problem. One or two computers in a classroom may not be enough to make optimal use of a CMRP. If a classroom is under-equipped, students may face long delays between finishing a book and being tested on it. According to information processing theory, long delays between when a text is read (encoding) and when a test is taken (retrieval) is problematic. The longer this interval is, the greater the chance that memory decay or interference will result in inaccurate comprehension assessment (Rayner & Pollatsek, 1989).

Sharon Klay, a Cook County (Illinois) elementary teacher experienced in the use of CMRPs, adds that "not only does a classroom have to be well equipped with computer hardware, support staff is often needed to iron out the logistics." Students need to be trained in fundamental computer skills, e.g., how to log on to the CMRP. Sharon added that "I rely on whatever support I can get to help orchestrate all the tests my second graders take." A class of thirty students needing two tests a day can spell disaster given insufficient hardware. When students are reading books that can be completed in one sitting, such as a well illustrated story book, a bottle neck of students needing to take tests on the computer can develop. Longer and more challenging books can avoid this problem given an insufficient number of computers in the classroom.

Conclusion

Instructors should determine what they want their CMRP to do for them, not to them. For a CMRP to be implemented properly, the instructor must identify the needs of the students relative to the amount of available resources (e.g., hardware). A realistic schedule can be devised to make maximum use of these resources. Classrooms that are under-equipped should not rely on the CMRP to monitor all of the students' reading. Rules such as 'one test a day' can help. In addition, for the best results the instructor should inculcate in students an attitude such that taking the tests does not involve a contest between students or a privilege. Rather, all students should have equal access to the machine and comparison's with a student's past performance should be emphasized. This will promote a learning goal orientation.

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Constructivist Uses of Technology for Second Language Learning

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Abstract: This article suggests the potential power of constructivist uses of technology to support second language learning using examples from sheltered instruction. It argues that the fields of learning technology and second language teaching share similar theoretical orientations and students would benefit from cross-disciplinary efforts to tie language acquisition theory and practice to the use of technology.

Teachers of English as a Second Language (ESL) recognize the need to teach language within the context of meaningful content learning. Sheltered Instruction combines the best of communicative language teaching with challenging content learning. It requires a variety of scaffolding strategies including modeling, bridging, contextualization, schema building, metacognitive development and text re-presentations that support second language learning (Walqui-van Lier, 1992). Technology has the potential to uniquely support each of these strategies. Yet few resources are available which help teachers of English Language Learners (ELL) to tie constructivist uses of technology to current second language acquisition theory even though both fields are grounded in the same evolving theories of learning. This article attempts to connect second language acquisition theories to constructivist technology uses in order to help Teachers of English to Speakers of Other Languages (TESOL) to improve their practice.

Theoretical Framework

We define sheltered instruction as grade-level instruction in academic classes for non-native students who have intermediate level English skills and who are literate in their own language. We also feel the sheltered instructional strategies suggested in this paper could be applied to any instruction that utilizes special techniques designed to assist non-native English speakers to more readily understand the subject matter. Our aim is to tie cognitive and social constructivist teaching/learning approaches for English Language Learners to technology learning environments.

Bruner (1986) proposed that much of what students learn depends on how they structure knowledge about themselves and their environment. Their ability to interact with their environment is influenced by the organization of that environment. Bruner advocated that educators provide instructional supports by scaffolding their teaching in ways that assist students' mental organization and development of schema. Constructivist uses of technology are grounded not only in cognitive constructivism with its roots in the work of Piaget and Bruner, but also in social constructivism. Willis, Stephens, and Matthew (1996) suggest the differences between these two theoretical perspectives. "Social constructivism spotlights the role of language as a tool used to spur forward intellectual growth; cognitive constructivism explores how language is processed at different stages of natural human development " . While the sheltered instructional approaches that will be discussed include an appreciation for each'student's internal mental processing, we are also concerned with language learning as it is influenced by socially and culturally-mediated activity. Vygotsky (1962) suggested many years ago how the learning community affects each individual's knowledge construction. He also made us aware of the importance of tools in influencing cognitive development. As technology tools evolve to become more flexible and powerful understanding the affordances of these tools is essential. (See Norman (1993) for more discussion.)

Constructivist theory has also evolved to include models of contructivism based on the notion of situated cognition which centers on the role authentic experiences play in helping learners construct their own meaning. Traditionally, much of education has separated knowing from doing. Knowledge has been treated as independent of the situations in which it is learned and used (Lave, 1988). Situated learning occurs when students work on authentic tasks in real world settings (Brown, Collins, & Duguid, 1989). Designing opportunities for students to learn deeply depends on recognition of the interconnectedness of tools, authentic activity, and the culture of practice (Norton & Wiburg, 1998).

Connecting Language Teaching Praxis and Technology Use

Sheltered instruction draws upon many approaches including theme-based, task-based, and content -based instruction. In this paper we have focused specifically on the various scaffolding techniques which can be used to support language learning and then tied them to uses of technology which may make these strategies more powerful. The topics covered include

- Modeling through the use of teacher-demonstrated products and processes
- Bridging connections between a student's personal experience and/or prior knowledge and new material through open-ended and anticipatory computer activities.
- Schema building using computer tools that help build graphical organizers
- Contextualizing through the use of hypermedia resources
- Re-presentation by taking one form of printed material and transforming it through presentation tools

• Meta-cognitive development as a result of thinking about technology-based manipulation of language.

Modeling

The teacher demonstrates a task or shows an example of a final product as a whole class activity. For example, the students might be shown a hypermedia stack on the planets and the example of a card about one planet filled out with answers to specific questions such as the size of the planet; distance from the sun; density; etc. Students would then be asked to fill out the information on another planet in the same way.
Many kinds of writing process software, such as *The Writing Process* by Scholastic, or *The Student Writing Center* (The Learning Company) provide examples of different types of writing and then guide the student through a series of computer-generated prompts to create a similar type of writing, such as a business letter, poem, or exercise in comparisons.

Bridging

A bridging activity establishes a connection between a student's personal feelings and/or prior knowledge and the theme of the new material. This helps make the material relevant to the student's life. Using an overhead projector and a word processing program in the one-computer classroom, the teacher can put up a variety of writing prompts related to the topic that will be discussed. These prompts can be anticipatory charts such as ones that encourage students to list what they know/want to know or agree/disagree about. A unit on world geography might be introduced with an interactive map program such as those available on the Internet. In the process of showing the program the teacher could ask the students to talk about where they came from and/or where their relatives or friends came from. The new maps available on the web can allow the teacher to zoom in and show locations very close to the students' present or previous homes.

Schema Building

Teachers can help students develop clusters of meaning that are interconnected through schema building. When words are introduced in meaningful context it is easier to learn language. The National Council of Teachers of Mathematics in their Standards suggests introducing mathematical concepts using well-grounded big ideas rather than isolated facts and bits of information. Schema building is supported by the use of computer-based drawing and idea development programs such as *Inspiration*. Students can develop and complete hierarchical concept and language charts, vocabulary trees, matrix diagrams and tables, and outlines of main ideas. For example when studying language students can begin to understand levels of language by visually constructing a class and specific example tree. Furniture is a class, a rocking chair is a type of furniture;

grandpa's blue rocker is a specific example. Computer software now makes it easy for a student to add pictures to each of these levels on a chart.

Contextualization

Contextualization provides contexts that make textbook and formal academic language more understandable. Manipulatives, pictures, and realia create a context that gives clues to the meaning of the material. The teacher or other students can also provide verbal contexts to make new language more comprehensible. A great example is new software programs such as Storybook Weaver that show vocabulary in context. One can build story scenes by selecting from groups of animals, people, buildings or scenery. Using multimedia authoring tools students can also contextualize new content and vocabulary by creating products such as stories or interactive scenes.

Metacognitive

Metacognitive development occurs as students reflect on their own thinking and learning processes. Three important parts to metacognition process include:

1) Planning a task and deciding appropriate strategy
2) Monitoring performance of task
3) Evaluating accomplishments of the task

Students will have opportunities to engage in all three of these steps as they think about technology-based manipulation of language to accomplish tasks and/or solve problems. A common strategy for helping students gain comprehension in the reading classroom is to use *Reciprocal Teaching* (). Students read one passage together. Student A reads a section aloud; Student B asks A two "thinking questions" (not simple fact questions). Student A responds and the two discuss the answers. Student A gives the text to student B, and the same procedure is repeated with student B doing the reading and A asking the questions. Using a computer authoring or word processing program students can take content and develop questions on that content for other students. The other students can open the developed program and add their answers to the document. You can have several students answering the questions on the same computer at a center in the classroom.

Using electronic portfolio program or simple word processed journals, students can record their information and periodically re-evaluate their progress using the documents they developed to help them measure their growth. Using a video camera as students explain what they are doing or what they have learned is another example of how technology can support metacognition especially as the students get opportunities to view and re-view their performances.

Text Re-presentation

Text re-presentation is a common strategy for helping students learn language. Students work with text to present it in some form other than the original version. For example, they might change a poem into a narrative; act out parts of a story; or write a dialog after watching a short skit. Using technology students can easily take printed material and transform it through the use of presentation tools or authoring programs. They might also take historical or personal autobiographical events and re-present them on a computer-generated time line or map.

Conclusion

We began this paper by suggesting that the fields of educational technology and Teaching English to Speakers of Other Languages share a similar foundation in terms of constructivist learning theory. We further suggested that the implementation of new theories of language acquisition in ESL classrooms can be uniquely supported by the use of technology tools including computer application programs, the Internet, and multimedia authoring programs. It is hoped that the specific examples provided for using technology to support sheltered instruction will help stimulate discussion, research and innovative practice in the use of technology to assist English Language Learners

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RESEARCH

Survey of Pre- and In-Service Educators' Ethical Attitudes

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Abstract: This paper presents initial results of a survey in progress of attitudes and opinions related to the ethical use of information technology in education. Respondents were graduate and undergraduate students enrolled in educational technology courses and gifted high school students enrolled in an internship program. The survey covered areas related to general computer issues, personal ethical actions, and educational uses of technology.

Introduction

Interest in public actions and attitudes toward the ethical use of information technology has been heightened due to the growth of and access to the World Wide Web. More people are directly involved with the creation, distribution, and consumption of electronic information than was ever previously thought possible. Due to the abstract nature of electronic information, responsibility for appropriate and fair use of information rests primarily with the individual. Recent information from an ethical organization cites surveys that report that 57% of public-school parents said that courses on values and ethical behavior should be taught by schools and of 1,000 Americans, 26 percent ranked "teaching children values and discipline" as most important to address in education today. It was listed ahead of all other issues, including "keeping drugs away from school" (24.9 percent), "setting higher achievement standards that students must meet (12.6 percent), "ensuring that schools are safe" (12.0 percent), and improving teacher quality (11.4 percent) (Global ethics, 1998).

Teacher educators and universities in general are in a unique position in that they are dealing with an audience that is in a greater state of flux than that of other social institutions. Education itself is being redefined as a result of the impact of information tools. Faculty are re-examining their internal value systems at the same time as they are responding to the task of guiding the next generation. Teacher educators have a responsibility to analyze and reflect upon their own information ethics while making students aware of appropriate behaviors for the access and use of electronic information.

The scope of ethical conflicts that occur at a educational institution fall into three main classifications: right of the individual versus the greater good of an organization or society; contradictory needs and varying interests of educational subcultures; and the intellectual role of the institution in encouraging open examination and questioning of social and moral issues (Smith, 1996). One of the implied roles of public school personnel is to present models of behaviors for students to adopt. Their actions in managing ethical conflicts reflect the ethics of the community and sometimes professional guidelines set by a few professional organizations.

Ethics governs conflicts between personal desires and social responsibility and obligations (Abbey,1997). As a personalized code of conduct, one's ethics provides guidelines on how to act when confronted with a situation not covered by formal sanctions or religious dogma (Forcht, 1991). The standards of right and wrong behavior set for oneself are based upon peer, family and religious influences, past experiences, and one's unique value systems. What are the behaviors exhibited by educators? What are the attitudes and opinions of educators concerning the ethical and acceptable uses of computers and information?

The purpose of this study was to identify in-service and pre-service educators' attitudes and opinions regarding the appropriate use of computer and electronic information technologies.

Methodology

The survey was administered during the Fall 1998 semester to 218 students attending a regional university. Subjects were 55 graduate students enrolled in four Master's level Educational Technology courses and 123 undergraduates enrolled in six Educational Technology classes. The questionnaire was also administered to 40 students enrolled in a career internship program for high school gifted and high achieving students.

A survey instrument was developed using items created by the author and items modified from several other survey instruments. Information from the following areas was requested:

> Demographic Information - included age, gender, employment category, major, approximate grade point average, experience with computers, and economic status and background;
>
> Respondent's Personal Opinions Concerning Ethical Use of Computers - 61 statements covered various types of computer related abuse, misuse, questionable actions, and appropriate uses in three broad areas of general computer issues, personal actions, and educational computer uses.

Items related to three of Mason's (1991) four categories of ethical problems were addressed: privacy, accessibility, and property. Privacy issues include concerns of personal intrusion or harassment and morality. Problems of accessibility deal with security concerns, equity, and resource allocation and abuses. Problems with the murky issue of electronic intellectual property rights and concepts of "fair use" are of major concern. Items also included issues of responsibility and management concerning procedures and mechanisms to control ethical infringements.

Respondents were asked to reflect his/her personal opinions by rating the questions or situations on a Likert scale. The Likert scale included choices of Strongly Disagree (1), Disagree (2), Agree (3), and Strongly Agree (4). The usual fifth option "No Opinion" was not offered in order to force a choice. A section on Personal Actions included slightly different choice options (Never, Sometimes, Often, Almost always). Four other items presented a three (Very rare - Occasionally - Very Common) or five choices scale (Very likely to Very unlikely or Excellent to Poor). Three of the items presented descriptive statements from which respondents could choose. It was assured that all scale options were presented in the same order - low/negative to high/positive. Individual questionnaires were not coded to assure anonymity, however, instruments were grouped in order to compare responses.

Analysis

Data was analyzed to look at relationships among demographic variables and ethical conflicts regarding privacy issues, intellectual property right issues, issues of access rights and privileges, and social responsibility and management issues.

Specific questions addressed relationships between and among:

> age and gender and privacy concerns, accessibility, and property rights,
> employment location and categories and privacy, accessibility, and property rights,
> content major and privacy concerns, accessibility, and property rights,
> grade point average and privacy concerns, accessibility, and property rights,
> computer experience and privacy concerns, accessibility, and property rights,
> work experience and privacy concerns, accessibility, and property rights,
> economic background and privacy concerns, accessibility, and property rights,
> and personal income and privacy concerns, accessibility, and property rights.

Additional questions dealt with the same personal variables and exposure to faculty attitudes, rights of management and authority, and procedures for control of ethical infringement.

Summary

Self-reporting surveys are often influenced by the subjects' perception of desired social behaviors (Ferrell & Ferguson, 1993). More than other professionals, teachers and pre-service teachers may be expected to respond

with what is perceived to be most socially acceptable rather than what is actually true for the respondent. However, the data collected through this survey presents information unavailable elsewhere.

Few resources were found that were directly related to ethics in education. It was necessary to extrapolate from works on information ethics (Dejoie etal, 1991; Oz, 1994), and the Internet (Smith, 1996, Dartmouth University, 1996). It was disappointing to find so little literature regarding educational ethics. This situation would appear to warrant further research and dissemination.

Many researchers and organizations examine behaviors and set standards specific to their discipline or interests e.g., bioethics, computer ethics, medical ethics, legal ethics, business ethics, etc. However, the field of education is rarely, if ever, identified as one of those disciplines whose practitioners examine or determine codes of behavior and/or ethical situations specific to the area. Professional organizations in education are actively promoting the tenet of "professionalism", yet few appear to be establishing unique professional ethical standards.

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School Technology Implementations & Results Research Project

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This study investigated the conditions, processes and consequences of instructional computer use by teachers in three elementary schools and compared and contrasted these across sites. A cross-case analysis grounded in symbolic interactionism and an interpretivist research methodology was conducted. Results indicate that teachers' beliefs and thinking about technology is socially constructed within local contexts and that teachers' beliefs and prior experiences influence instructional computer use. The processes teachers engage when using technology in classroom instruction varied greatly, however, they resulted in similar consequences. This study raises significant questions about educational technology policies, teacher education and professional development models.

Introduction

Increasingly, administrators and teachers are told that technology holds the key to educational improvement and change. Policymakers assume that technology is the silver bullet that will revolutionize education. The federal government and state governments are redirecting billions of dollars into technology for classrooms with little understanding about how this technology is received and used by teachers working in actual classrooms. Policymakers imagine technology and learning as a black box. They assume that simply adding technology into classrooms will lead to improved student learning. In that black box, the instructional practices and professional development needs of teachers are ignored. It is imperative to understand the relationship between technology and teachers' instructional practices in order to understand the impact of technology on student learning. Previous research has not adequately conceptualized this relationship. This is a qualitative case study that investigated the "typical" use of technology by teachers in three elementary schools under the conditions in which they teach. The purpose of the study was twofold: (1) to investigate the conditions, processes and consequences of teachers' instructional computer use in numerous elementary classrooms within three schools and (2) to compare and contrast the effects of these conditions, processes and consequences across the three selected sites.

A Qualitative, Cross-site Approach

Research on educational technology is replete with surveys which analyze teachers' attitudes toward instructional computer use (Loyd & Gressard, 1984), report teachers' self-efficacy using various educational technology (Delcourt & Kinzie, 1993; Olivier & Shapiro, 1993), report instructional practices (Becker, 1991), determine factors influencing instructional computer use (Becker, 1994; Maricinkiewicz, 1994) and categorize teachers according to instructional computer uses (Evans-Andris, 1995; Hadley & Sheingold, 1993). More recent studies analyze how teachers use of computers may change their basic instructional philosophy and practice (Becker, 1998; Dexter & Anderson, 1998). These studies are valuable to the field and provide much useful knowledge. However, most research designs have employed data which relies on teachers' self-reports rather than direct observations of instructional practices. More knowledge about how teachers think about and engage technology in practice is necessary to make the most advantageous use of technological resources in classroom teaching.

Case studies related to educational technologies are becoming increasingly popular in the field. Several case studies have examined teacher education programs considered exemplary in technology integration (Strudler and Wetzel, 1998; Persichitte, 1998). Other case studies have examined technology-rich K-12 classrooms (Dwyer, 1994) and K-12 schools engaged in technology-supported reform efforts (Means,

1998; Schofield,1996). These case studies have been useful in understanding how technology influences the teaching process. However, they have focused primarily on single sites and have examined schools and classrooms considered exemplary in their use of technology. This qualitative, multiple case study of technology and teaching practice is distinctive in at least two ways. The schools selected for this study are average or typical elementary schools with regard to technology use. That is, these schools have not been identified as exemplary in computer use nor can they be considered advanced in terms of technology resources. In addition, three elementary schools from two districts were selected to enable a cross case analysis of the impact of technology on teaching at the sites.

Paradigm and Conceptual Framework

Since we were interested in administrators' and teachers' definitions and interpretations about technology and classroom practice, this study employed a symbolic interactionist (Blumer, 1969) conceptual framework and an interpretivist research methodology (Erickson, 1986). According to symbolic interactionist theory, teachers and principals redefine and reinterpret messages about technology that they receive. They then act according to their own definitions of the situation (Blumer, 1986; Smith, Noble, Cabay, Heinecke, Junker & Saffron, 1994). The conditional matrix (Strauss & Corbin, 1990), a form of symbolic interactionism, conceptualizes social actions as a connection between conditions, processes, and consequences. The conditional matrix was used in this study to identify the conditions, process and consequences of technology use in classrooms.

The following issues, identified by Schofield (1995), have also guided our conceptual framework: (1) teachers' beliefs about the appropriate use of technology (2) teachers' beliefs about the goal of using technology (to change practice or make practice more efficient), (3) barriers that are a function of traditional classroom practice and culture (e.g. reliance on lecture and rote software), (4) school and school district level factors (e.g. teacher training and testing), and (5) teacher attitudes toward computers (e.g. computer phobia, notions of classroom authority and technical support).

Methods and Data Sources

Specifically, we employed an interpretivist research strategy (Erickson, 1986) and a multiple case study design (Miles and Huberman, 1986). This design is based on the rationale that understanding complex processes such as classroom computer use requires multiple site visits over an extended period of time. We sought careful grounding in local cases as a prelude to a cross-case analysis. Using multiple cases provides an interpretive context for each case developed.

Case Selection

Three elementary schools were chosen for the study. This number was chosen due to the resources available to support researchers in the field. Average technology using schools were selected for this study. An urban, a rural and a suburban elementary school were selected not in order to increase the external generalizability of the study but rather to improve the internal validity of each case study. This strategy prevents researchers from overlooking some aspects of cases deemed not salient. Seeing multiple cases in parallel can alert researchers to such oversights. Only elementary schools were chosen in order to make the cross-case analysis more meaningful.

Each researcher developed a detailed case study of technology and teaching at her site. Consistency across researcher perspectives was maintained in several ways. First, a common design for data collection and common definitions were developed by the team. Second, the theoretical framework focused attention on common issues at the sites. Third, bi-monthly meetings were held to address issues and concerns and to share preliminary findings. Fourth, a project manager monitored the quality of data collection and analyses procedures. Finally, all members of the team read each case study and reactions were incorporated into the final cross-case analysis.

Data Collection

The unit of analysis for this study was defined as individual teachers within the school. Once the sites were selected, researchers negotiated access to the classrooms of five teachers at each site. Access was

negotiated with the school principal and participating teachers, and five teachers were selected based on the resource constraints of the project.

Data for each case study was gathered over a seven month period via classroom observations, teacher and principal interviews and document collection. Researchers took the role of observers rather than participants. Protocols for the observations and interviews were developed both from the conceptual framework and from initial data collection. Researchers took detailed observation fieldnotes and tape recorded interviews. Fieldnotes were developed into detailed observation write-ups and interviews were transcribed. Data and write-ups were submitted to the research coordinator and were reviewed for detail and thickness of description.

Data Analysis

Within Site Data Analysis

Data analysis was conducted using the techniques of analytic induction as specified by Erickson (1986). In the first step of analysis empirical assertions related to the research questions were generated. Researchers coded data based on emergent themes and categories as they developed in the course of investigation. The researchers initially employed sensitizing concepts according to conceptual categories derived from literature related to teachers' instructional computer use (Becker, 1991; Vockell & Sweeney, 1993; Means, 1998), conditions related to instructional computer use (Willis, 1993; Marcinkiewicz, 1994; Means, 1998), processes related to instructional computer use (Hadley & Sheingold, 1993; Hawkins, 1996), and consequences related to instructional computer use (US Department of Education, 1995; OTA, 1995; Glennan & Melmed, 1996; Means, 1998). Other emergent conceptual categories such as the role of technology in context of teaching, the meaning of technology to teachers, and the relationship of technology to the curriculum, pedagogy, and school organization were used to frame data analysis.

The second phase of analysis consisted of establishing warrants for the assertions generated through a rigorous and systematic search for confirming and disconfirming evidence in the data record. Assertions or statements about the use of technology by teachers, inductively derived, were developed and revised. Finally, vignettes or other empirical exemplars were provided to support the assertions.

Cross-site Data Analysis

Each researcher created her own case record and submitted data to the project coordinator for cross case analysis. Data was entered into a computer-assisted qualitative data analysis software package, Folioviews, for management and analysis. From the individual cases and team meetings, we then developed a cross-site matrix to compare sites and reduce the amount of information presented without losing the grounding and authenticity provided by each case (Smith et. al, 1994). We employed the conditional matrix (Strauss and Corbin, 1990) from our conceptual framework of symbolic interactionism to construct the categories for the cross-site analytic matrix. These categories were conditions of technology use, processes of technology use and consequences of technology use.

Results

Results indicate that teacher technology use in conventional settings varies significantly from results of previous studies conducted in technology-rich environments. Teachers' beliefs and thinking about technology is socially constructed within local contexts. These local contexts included the role of the principal, peer relations and resource support. Teachers' beliefs and prior experiences influenced their instructional computer use. The processes teachers engage when using technology in classroom instruction varied among classrooms and sites. However, these processes resulted in similar consequences concerning instructional activity. This study raises significant questions about educational technology policies and their impact on classroom practices. It also raises questions concerning teacher education and professional development models and their role in effective technology use in classrooms. Technology infusion is contingent upon environmental factors. In Virginia the newly implemented "Standards of Learning," and parental/ public views of the importance of technology have had an impact on the push for technology in the schools. However beyond meeting access needs, Virginia is recognizing new disparities arising in the use of technology toward engaging student learning. These disparities stem from leadership within the schools and the appropriateness and accessibility of training provided for teachers.

Educational Significance

Because of distinctive features of design and focus, this study is significant to the field in several ways. It provides information about how typical schools are using technology in instruction. It also provides insight into how schools approach computer use differently depending on unique contexts. Finally, the results of this study open up the black box between policy and practice. As educational technology budgets continue to grow, this study highlights the need for policy makers, when making allocation decisions, to consider instructional processes within school cultures. This study provides relevant information to guide policy development in this area.

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Mentoring Pre-Service Teachers for Technology Skills Acquisition

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Abstract: There is a great need for increased competency at technology integration by public school teachers. Among the best ways to encourage assimilation of those skills by pre-service teachers is to model the effective use of technology in both college and clinical classrooms. Four hundred-eleven pre-service teachers were surveyed to determine to what degree were their professors' and supervising teachers' modeling the use of technology. The only technology that was used consistently was wordprocessing. Differences among the various major professors modeling of technology skills were also found.

Introduction

The recent growth of computer use and web-based technology is changing the way our society functions (Jerald, 1998). These tools are influencing the way we think about, access, and use information. In an effort to prepare students for the information age, public schools are increasing access to these tools by putting more hardware and software in schools; connecting schools to the internet; and providing cable and satellite capabilities (Zehr, 1997; Zehr, 1998). However, having access to technology tools is only part of the answer. Teachers must become more knowledgeable about technology, and be able to integrate them into their teaching and student learning. Districts throughout the country are making efforts to increase the use of technology through staff development activities and providing on-going building and district technology support. However, this training must begin with pre-service teacher education (Wetzel, Zambo, Buss, & Arbaugh, 1996).

Pre-service teachers will be the teachers of the 21st century. As such, they must develop the necessary technology knowledge and skills to prepare the next generation of students. If they do not, they will perpetuate the lack of technology expertise that is characteristically the norm of the current generation of teachers. Not acquiring these skills during their pre-service program will cost schools districts greater hardships because they will ultimately have to bear the financial responsibility for expensive staff development activities. The bright side is that in a nationwide study of recent pre-service graduates, the majority felt that they were well prepared to use technology in their teaching (Colon, Willis, Willis, & Austin, 1995).

Technology mentoring must become an essential component of the pre-service development of the potential teacher. Content knowledge and skill development about one's discipline is essential; however, good technology mentoring is only achieved through role modeling, on-going evaluation, constructive criticism, and coaching (Wright & Wright, 1987). Pre-service teachers should be afforded these mentoring elements in their content, methods, and professional education courses; through their classroom observations and experiences; and during their student teaching experiences. It is through these experiences that university professors and supervising teachers help pre-service teachers become knowledgeable about content and methods. However, are these mentors arming their proteges' with the necessary technology tools and skills for the information age (Niederhauser, 1996; Wetzel et al., 1996)?

Research Question

This research reports the findings of a two-year study designed to discover if professors and supervising teachers were modeling technology skills for pre-service teachers, what technologies were used, and were they integrating technology tools and skills into their teaching? The question that guided this research was "What was the impact of faculty in acquiring and motivating technology skills used by pre-service teachers?

Methodology

Instrumentation

To investigate the ways student teachers assimilated and applied technology in their newly chosen profession, a survey of student teachers was conducted. Questions investigated their perceptions of:

- Technology utilization of 12 different technologies by their supervising teacher during student teaching. The 12 technologies that were surveyed were wordprocessing (WP), spreadsheet (SS), database (DB), desktop publishing, electronic presentations (e.g. PowerPoint), the Worldwide Web, email, Galileo (a statewide research database), videodisc, satellite TV (including videotape derivatives), GSAMS (a statewide 2-way audio/video distance learning technology), and Channel 1. Utilization was classified as "Not at all," At least once," "Weekly," and "Daily."
- Modeling of technology skills by undergraduate teacher program instructors in three different areas:
    - Core classes
    - Professional Education classes
    - Specialized Content for Teaching classes.

These areas were rated on a four (4) point Likert scale (None, A little, A moderate amount, A great deal).

The Core Curriculum is required in all bachelors degree programs and is usually completed during the freshman and sophomore years. The courses total 90 quarter hours and cover areas such as Humanities and Fine Arts, Mathematics and Natural Sciences, Social Sciences, Health and Physical Education, and lower division courses appropriate to the major.

Professional Education courses in the B.S.Ed. curriculum are those which contain the particular knowledge and skill development involved in teaching. Courses in this area typically cover teaching methods, curriculum, learning and motivation, special needs students, and student teaching. This segment usually requires 40 - 45 quarter hours.

Specialized Content for Teaching is the portion of the B.S.Ed. program that prepares the pre-service teacher in the content they will teach in the classroom. In the secondary and P-12 programs, it is equivalent to a major in the teaching field. Fifty to sixty quarter hours are typically required.

The complete survey in PDF format is available at < http://www2.gasou.edu/eltr/tech/rcarlson/stsurvey.pdf>.

To facilitate the analysis, the use of 12 different technologies by faculty was treated as a summative scaled variable - that is, the individual scores for each of the 12 responses were summed to arrive at an overall technology use score. Reliabilities using Chronbach's Coefficient Alpha ranged from 0.89 to 0.91, an indication of very high score reliability.

Subjects

The subjects for this study were graduating seniors from a midsize southern university who completed a survey instrument at the end of their student teaching experience. A total of 444 students participated in the practicum experience during the Spring quarter 1997 through the Spring quarter 1998. Four hundred ten (410) surveys were returned for a 92% return rate. The fact that the survey was included along with the course materials, helped to motivate the return of the surveys.

Results

Sample Demographics

	TOTAL	ECE	EXC	MG	SEC	OTHER
White	79%	76%	82%	80%	81%	83%
Black	17%	21%	18%	16%	14%	13%
Hispanic	1%	1%	0%	1%	2%	4%
Other Ethnic Groups	2%	2%	0%	2%	2%	0%
Female	81%	97%	82%	84%	60%	61%
Male	19%	2%	18%	16%	40%	39%
Note. ECE = Early Childhood Education; EXC = Exceptional Child Education; MG = Middle Grades Education; SEC = Secondary Education; OTH = Other education majors						

Table 1: Sample Demographic Characteristics.

A total of 410 student teachers, predominantly white and female (Table 1), responded to the survey. Early childhood educators were the largest group followed by secondary educators. Special, middle grades, and other educators were about evenly represented. Other educators were classified as those who did not fit into one of the listed categories, such as business, health and physical education, music, and art. Ethnic groups other than white and black were eliminated from further analysis because of their small representation. Age ranged from 20 to 57 years with a median at 23 years and a mode of 22 years.

Modeling of Technology

Supervising Teachers

	Not at All					At Least Once					Weekly					Daily				
Technology	TOT					TOT					TOT					TOT				
	EC	EX	MG	SE	OT	EC	EX	MG	SE	OT	EC	EX	MG	SE	OT	EC	EX	MG	SE	OT
WP	26					25					26					24				
	24	40	26	18	38	26	25	26	23	19	31	23	23	22	21	20	13	26	37	23
DB	70					15					10					6				
	70	88	68	63	63	15	5	17	20	14	12	8	11	8	8	3	0	4	10	14
SS	70					14					9					7				
	70	93	66	60	71	14	5	17	18	12	11	3	9	10	6	5	0	9	12	10
DT Pub	74					13					7					7				
	71	90	72	71	73	17	0	15	11	13	7	10	4	7	4	5	0	9	11	10
Presentation	78					14					6					2				
	83	88	79	64	77	12	8	17	20	13	5	3	4	9	8	0	3	0	8	2
WWW	73					15					7					5				
	74	83	88	64	63	14	13	9	21	14	9	3	4	6	14	4	3	0	10	8
Email	83					7					4					6				
	84	88	94	76	77	5	10	4	11	10	5	3	2	2	4	6	0	0	11	8
Galileo	90					6					2					2				
	91	88	96	86	90	4	10	2	10	8	2	0	2	1	2	2	3	0	3	0
Videodisc	91					7					2					1				
	93	97	89	85	90	4	3	11	10	10	2	0	0	4	0	1	0	0	1	0
TV	74					13					10					3				
	68	88	81	69	88	13	8	17	19	6	16	5	2	8	4	4	0	0	4	2
GSAMS	95					4					1					0				
	95	99	96	94	90	4	0	4	6	6	1	0	0	0	4	0	0	0	0	0
Ch 1	72					6					5					17				
	91	90	63	35	74	5	3	9	9	6	4	5	4	8	4	1	3	24	48	16

Note. All numbers are percent of the total. WP = wordprocessing; DB = database; SS = spreadsheet; DT Pub = desktop publishing; TOT = Total; EC = Early Childhood Education; EX = Exceptional Child Education; MG = Middle Grades Education; SE = Secondary Education; OT = Other education majors.

Table 2: Technology Modeling by Supervising Teachers.

A major factor in the use of technology is the behavior of those near them who are in instructional or supervisory roles. When student teachers were asked about the use of technology by their supervising teachers, very few indicated that technology was used frequently. Of the 12 identified technologies, only 50% or more of the supervising teachers (Table 2) used wordprocessing at least weekly. On the other hand, more than two-thirds of the student teachers reported that their supervising teacher never used any of the technologies except for wordprocessing.

Higher Education Professors

	Av Core	Best Core	Av Prof	Best Prof	Av Spec	Best Spec	Total
WP	2.94	3.12	3.12	3.28	3.02	3.14	18.62
DB	1.96	2.24	2.22	2.60	2.16	2.35	13.53
SS	1.89	2.20	2.09	2.49	2.04	2.26	12.97
DT Publishing	1.72	1.98	1.96	2.30	1.93	2.10	11.99
Presentation	1.96	2.29	2.20	2.61	2.10	2.37	13.53
WWW	2.35	2.55	2.54	2.89	2.45	2.62	15.40
Email	2.35	2.55	2.52	2.81	2.44	2.64	15.31
Galileo	2.10	2.23	2.22	2.42	2.18	2.31	13.46
Videodisc	1.53	1.70	1.55	1.79	1.54	1.60	9.71
TV	1.48	1.56	1.49	1.63	1.47	1.51	9.14
GSAMS	1.18	1.27	1.21	1.28	1.25	1.27	7.46
Channel 1	1.17	1.24	1.22	1.28	1.23	1.21	7.35

Note. WP = wordprocessing; DB = database; SS = spreadsheet; DT Publishing = desktop publishing; Av Core = Average Core Professor; Gr Core = Core Professor Using Technology to the Greatest Extent; Av Prof = Average Professional Education Professor; Gr Prof = Professional Education Professor Using Technology to the Greatest Extent; Av Spec = Av Spec = Average Specialized Content for Teaching Professor; Gr Spec = Specialized Content for Teaching Professor Using Technology to the Greatest Extent.

Table 3: Technology Modeling by Undergraduate Professors.

The student teachers should have been influenced by the way their professors used technology in the classroom. Innovative, motivational uses of technology in the undergraduate teacher education program may motivate the teachers to use it in their own instructional setting. Table 3 shows the average ratings for teachers encountered in teacher preparation programs. Students were asked to rate the average and the best of their professors in core, professional education, and specialized content for teaching classes. Wordprocessing was used to the greatest extent by these professors, followed by internet (WWW and email) usage. Videodiscs, Television, GSAMS, and Channel 1 had the lowest usage.

	Av Core	Gr Core	Av Prof	Gr Prof	Av Spec	Gr Spec
Ethnic	NS	NS	NS	NS	NS	NS
Gender	NS	NS	NS	NS	NS	NS
Major	NS	NS	Sig (.048)	Sig (.004)	Sig (.035)	Sig (.036)
Model	NS	NS	NS	Sig (.006)	NS	NS

Note. Av Core = Average Core Professor; Gr Core = Core Professor Using Technology to the Greatest Extent; Av Prof = Average Professional Education Professor; Gr Prof = Professional Education Professor Using Technology to the Greatest Extent; Av Spec = Average Specialized Content for Teaching Professor; Gr Spec = Specialized Content for Teaching Professor Using Technology to the Greatest Extent; NS = not significant; Sig (xxx) = significant (p value).

Table 4: Significant Differences by Group for Technology Modeling by Undergraduate Professors.

ANOVAs were accomplished to compare student ratings of professor technology use between groups. The dependent variables were scores that were the sum of all the 12 technologies. Chronbach's Alpha reliabilities of these scores ranged from .89 to .91. Table 4 summarizes the comparisons by groups.

There were no statistical differences between males and females or among the ethnic categories. There were differences among the identified majors, however the statistical model was significant only once - in the case of the professors who used technology to the greatest extent. Table 5 shows the total scores adjusted for the effects of the other factors for the various majors.

	Av Core	Gr Core	Av Prof	Gr Prof	Av Spec	Gr Spec
Grand Mean	22.38	24.74	24.30	27.26	23.74	25.41
ECE	.52	.50	.26	-.05	.65	.79
EXC	1.85	1.46	3.00	2.39	2.92	2.61
MG	.16	.73	-1.58	-.32	-.88	-1.11
SEC	-1.00	-.75	-.42	1.28	1.12	-.38
OTHER	-1.63	-2.66	-.98	-3.97	-1.88	-3.27

Note. Av Core = Average Core Professor; Gr Core = Core Professor Using Technology to the Greatest Extent, Av Prof = Average Professional Education Professor; Gr Prof = Professional Education Professor Using Technology to the Greatest Extent; Av Spec = Average Specialized Content for Teaching Professor; Gr Spec = Specialized Content for Teaching Professor Using Technology to the Greatest Extent; ECE = Early Childhood Education; EXC = Exceptional Child Education; MG = Middle Grades Education; SEC = Secondary Education; OTHER = Other education majors.

Table 5: Deviation from the Grand Mean by Group for Technology Modeling by Undergraduate Professors.

In every case, students majoring in Exceptional Childhood Education rated technology use by their professors higher than those majoring in other disciplines did. Similarly, students classified as "other" rated their professors lower than those in other disciplines.

In the case of professors in professional education classes who used technology to the greatest extent, students majoring in Exceptional Childhood and Secondary Education rated their professors above average, while those classified as "other" rated their professors well below the average.

To test the hypothesis that there were differences among the way students rated the professors, a repeated measures ANOVA was accomplished. Pillais, Hotelings, and Wilkes tests showed significance (F=2,28, df= 5, p=0.47). Within group variables were the six professor groupings and the between group variables were ethnicity, gender, and major. The within factor significance was p=0.33 (F=2.44, df=5). The professional education professors who used technology to the greatest extent averaged a significantly higher mean score than any of the other professors.

Discussion

This study confirms previous research which showed that the only classroom technology that educators are comfortable using is wordprocessing (Wetzel,1993). This was the only technology used at least once per week by 50% of the supervising teachers. The next highest technology type was Channel 1, used at least weekly by only 22 % of the supervising teachers. Access to technology may have limited supervising teachers from using technology to a greater extent than they did. Similarly, student teachers rated the modeling of technology by their professors at least 3 on a 4-point scale only for wordprocessing. The closest next technology was internet related and was one-half point lower on average.

Most technology is underutilized; therefore, student teachers have little opportunity to see it modeled in their college classroom setting by their university professors or in their practicum setting by their supervising teachers. If student teachers are not shown how to use technology they should not be expected to integrate it into their lessons. This encourages the continued underuse of tools that have great potential to help students learn.

When asked to rate their university professors on modeling technology use, student teachers rated their professional educational professors highest, followed by specialized content professors, and lastly core professors. This is somewhat concerning in that core and content area teachers may be underutilizing important teaching tools. When looking at technology modeling by major, students studying Exceptional Childhood Education rated all of their professors higher than any of the other majors. Conversely, other majors rated their professors lowest. Looking at the rating of the Core professors which should be equally rated, one finds that Exceptional Childhood Education majors rated these professors high and other majors rated these professors the lowest. However, these ratings showed no statistical difference. The only statistical difference was for the professional education professors who used technology to the greatest extent.

Recommendations and Conclusion

Although Colleges of Education should continue to emphasize the use of technology as a teaching tool in all of their pre-service educational programs, it should be understood that it must be a university-wide mandate. It is imperative that technology modeling and use also take place in core and specialized content area courses. To achieve this, professors must have technology access not only in their offices, but also in their classrooms. They must also have technology support when needed. Colleges should also provide on-going, small group or one-to-one staff development activities for professors.

When considering student teacher placement, the technology awareness of the supervising teacher and his/her colleagues should be one criterion for selection. Another should be the level of access the student teacher will have during the experience.

Supervising teachers must begin to view student teachers as a technology resource because of their familiarity and comfort level with the technology. For instance, when preparing lessons, make it the student teacher's responsibility to integrate one or more technologies.

Finally, colleges of education and/or individual departments should sponsor activities where student teachers and their supervising teachers demonstrate and celebrate the integration of technology into teaching and learning. Besides providing an opportunity for student teachers and supervising teachers to "show-off," it would also be an opportunity for professors to see innovative ways to integrate technology into their teaching; thereby raising their learning curve.

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Preservice versus Inservice Educators' Attitudes Toward Information Technology

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Abstract: This paper compares and contrasts attitudes of preservice teachers to those of inservice teachers and administrators. In the first section we describe categories of preservice and inservice educators from which data has been gathered, while the second section addresses data collection and instrumentation. The third section includes findings and their implications for the field of teacher education.

Categories of Preservice and Inservice Educators

Two categories of preservice teachers are examined:

a) those taking university coursework on campus, and
b) those involved in student teaching in classrooms.

Two categories of inservice teachers are singled out as well:

a) classroom teachers in general, and
b) teachers who are mentors of student teachers.

Data Samples and Instrumentation

Data Samples

Findings for this paper are based on three sets of data gathered during 1995-98:

Set 1: 1995-96 data gathered from 138 K-12 teachers in a large South Texas school district, contrasted with data from 19 interns (student teachers) from the same district and during the same time frame;

Set 2: 1997-98 pre-post data gathered from 29 preservice educators enrolled in university coursework prior to student teaching; and

Set 3: 1997-98 comparison data gathered from 212 teachers in six Texas school districts during January - March, 1998.

Instrumentation

All preservice and inservice educators completed some version of the Teachers Attitudes Toward Information Technology Questionnaire (TAC) or the Teacher's Attitudes Toward Information Technology Questionnaire. These instruments measure from 7-16 psychological constructs such as computer anxiety, classroom productivity, and teacher productivity. They have previously been shown to be reliable measurement instruments (Christensen & Knezek, in press; Knezek & Christensen, 1998). A Stages of Adoption of Technology questionnaire based on work done by Russell (1995) was administered to most of the subjects to determine their perceived stage of technology integration. Six stages are included in this instrument: (1) Awareness, (2) Learning the Process, (3) Understanding and application of the process, (4) Familiarity and confidence, (5) Adaptation to other contexts, and (6) Creative application to new contexts.

Findings and their Implications for Teacher Education

Analysis of the 1995-96 data (Set 1) indicates that many of the distinctions between preservice and inservice educators may be due to a generation gap. For example, the 1995-96 interns believed that reading is difficult, relative to the perceptions of their inservice peers. Also the 1995-96 interns reported a preference for working on a computer over reading, writing, or even watching TV, while the inservice teachers had a more even distribution of preferences among these four alternatives. In many other attributes, such as computer importance or enjoyment, inservice educators with no prior exposure to information technology tend to acquire attitudes similar to those possessed by preservice educators, after meaningful information technology inservice training has taken place.

The general trend in this data appears to be that preservice teachers are entering the profession relatively comfortable with technology, compared to their inservice peers. This corroborates recent observations by the authors that first year teachers can often skip the beginning 6-8 hours of standard information technology awareness training, because they generally come into the profession with these skills. Such trends imply that a "buddy system" in which new teachers instruct veterans on information technology skills, while experienced teachers instruct novices on classroom management and teaching techniques, might serve to benefit both groups.

Data Set 2 from preservice teachers enrolled in an elective computers in the classroom course prior to student teaching included a pre- and posttest of their attitudes. The course focuses on how to integrate computers into the classroom rather than how to use them for productivity.

A paired t-test was performed on the preservice teacher data. As shown in Table 1, both Multimedia and Stages were significantly changed from pre to post ($p<.001$). Students moved up an average of one stage on the Stages of adoption of technology measure. The pretest mean was 4.36 while the posttest mean was 5.23).

Subscales	n	M	SD	SE	t (df)	prob	No. increased	No. decreased	# ties	Bi-nomial
Email (pre)	26	5.73	1.07	.210						
Email (post)	26	5.94	1.08	.212	-1.07 (25df)	.294	17	8	1	.1078
WWW (pre)	26	6.10	.912	.179						
WWW (post)	26	6.35	.733	.144	-1.52 (25df)	.142	16	6	4	.0525
MM (pre)	23	5.48	1.35	.281						
MM(post)	23	5.99	.98	.203	-.2.13 (22df)	.044*	13	7	3	.2632
ProdT (pre)	25	6.37	.75	.151						
ProdT (post)	25	6.24	.84	.169	.73 (24df)	.48	8	9	8	1.00
Class(pre)	25	6.57	.59	.117						
Class (post)	25	6.41	1.03	.206	.72 (24df)	.48	11	5	9	.2101
Stages (pre)	22	4.36	1.00	.214						
Stages (post)	22	5.23	1.02	.218	-4.31 (21df)	.00*	15	2	5	.0023

Table 1: Paired t-test and sign test from university students in the teacher education program

Results of a nonparametric sign test showing how many students' attitudes increased, decreased or tied from pre- to posttest administration are listed in Table 1. With the exception of Productivity for teachers, all Semantic Differential subscales (see Appendix) showed an increase in attitudes during the course of the semester.

Table 2 contains a comparison of attitudes toward: a) E-mail for teachers, b) the World Wide Web (WWW), c) Multimedia, d) Computer Productivity for teachers, and d) Computers in the Classroom for several groups of educators including preservice and inservice teachers. The preservice teachers began their fifteen week course of study well above the mean attitude for teachers in general, but lower than the highest inservice teachers. By the end of the course, the preservice educators were higher than the inservice teachers on all scales for which comparative data was available.

	Inservice 6 school Means	Preservice course pretest	Preservice course posttest	Inservice Highest of 6 schools
Email	5.25	5.73	5.94	5.83
WWW	5.68	6.10	6.35	6.28
MM	-	5.48	5.99	-
ProdT	5.91	6.37	6.24	6.18
Class	6.02	6.57	6.41	6.33
n	212	26	26	34

Table 2: Comparison of preservice teacher pre-post attitudes to typical and highly positive inservice teacher attitudes

Many of the variables studied were highly positively correlated with stages of adoption for the pretest but insignificantly correlated by the post test. This may indicate that only students in a high stage of adoption at the beginning of the course were able to see the value of information technology for their future students, but by the end of the course most students (preservice teachers) saw the value of computers in the classroom regardless of the stage in which they resided. For example, the item "For my students, using computers in the classroom is valuable" was highly correlated with stage of adoption for the pretest (.5156*) but not significant for the posttest (.2099). This type of information, combined with the fact that students in the class advanced an average of one stage from the beginning to the end of the semester, led to the conjecture that even students in lower stages of adoption came to perceive the potential value of computers for their students, by the end of the course. Further research is needed to confirm or refute this hypothesis.

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Appendix: Description of Semantic Differential Items

The same semantic differential adjective pairs were used for each of five targeted subject items.

To me, electronic mail is:
To me, using the World Wide Web is:
To me, multimedia is:
To me, using computers for my professional productivity is:
For my students, using computers in the classroom is:

Example:
Instructions: Place an 'X' between each adjective pair to indicate how you feel about the subject.

To me, electronic mail is:

Important _____ _____ _____ _____ _____ _____ _____ Unimportant

Important/unimportant
Boring/Interesting
Relevant/Irrelevant
Exciting/Unexciting
Means nothing/Means a lot
Appealing/Fascinating
Worthless/Valuable
Involving/Uninvolving
Not needed/Needed

Masters Students Developing Research Proposals and Published Articles

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Abstract: Masters-level students within the specialization area of Instructional Technology have a disconcertingly succinct speaking ability; however, such speaking abilities may not necessarily lend themselves towards the written word. Masters-level students, especially with backgrounds in the area of teacher education, offer wide ranges of abilities within numerous areas of skill. Such skills can range from strengths within the areas of training, public speaking, instructional design, curriculum development, instructional development, research and statistical calculations; however, the same students that display such awesome strengths within their repertoire of abilities may have areas that can be further developed. One of the areas of further development is within the arena of developing written research proposals and publishable articles; writing literature reviews, thoughts, experiences and research in publishable formats so as to advance the literature of instructional technology is an area that may be wrought with difficulties.

Introduction

Masters-level students come from numerous walks of life and have several hats, which they wear through out the day. One of these hats is the student hat; this hat requires that the students not only process vast amounts of information, synthesize this information into coherent and presentable bits of information and display public speaking abilities, but the students also must define themselves as persons with distinct abilities within the area of penmanship. Masters students are expected to write numerous reports through out their time as students, taking into account that the primary audience will be the instructor of record. However, what is the result when the students are no longer writing to merely the instructor, but to a much wider audience?

The instructor is, of course, a primary audience to all students reaching to attain the honor of a masters degree; but when the students begin to delve into writing journal articles, theses, grants and reports, what type of disconcerting elements are felt by the student? Each person that writes at a scholarly level must work through their own sense of inability and insecurity, and most authors do indeed feel that sense of frightened anticipation as to whether their work, over which they have slaved and into which they have put their heart and soul, will be accepted and admired by peers. It is no different for masters students merely beginning their soulful journey into the ranks of the scholarly. Now students must not merely read, analyze and spout thoughts written by persons to whom they have held as superior through out many years of study; now these same students must decide upon a topic of interest, analyze the available research, and delve into the construction of their own thoughts, beliefs, scholarly voice and strategies for the development of scholarly research. To some students this is not a difficult task; however, to most students this is a frightening point at which not only their years of schooling are at issue but also their personal desire to be accepted as a part of the scholarly community.

All researchers began their scholarly career with very little understanding of numerous issues such as the formatting, reference guidelines, writing voice, and level of work that are deemed to be acceptable and expected within the scholarly community. The difficulties surrounding the progress of masters students from writers to scholarly writers and researchers are ones which must be overcome. Masters students have found certain difficulties through out this process; specifically, the students have found themselves in a

quandry concerning such basic issues as understanding the process through which one must travel to obtain relevant research and information upon the subject matter in question, obtaining previous research upon their subject matter, analyzing the obtainable research, formatting issues, reference guidelines and overcoming their basic, undeniable fear of submitting their scholarly endeavors to a wider audience.

Subject Matter

The first area of concern in introducing the topic of scholarly research to many students seems to be the focus upon one specific area or topic to research. I found this to be particularly difficult until switching the idea of a topic to the development of a proposal paper that could turn into the first two chapters, introduction chapter and review of related literature chapter, of a masters thesis. This shift seemed to focus the students upon an experience that they could use towards their degree program, and not merely another staid attempt to complete a paper in order to please the instructor. Instead, the students focused upon topics that they found to be intriguing and ones that could indeed develop into reviews of literature for a thesis paper.

The students in this specific course were soon to be graduating and were interested in developing a paper that could coincide with another course, Research Design and Development, in which they either were enrolled or would be enrolled within the next semester or two. Luckily, the introduction and review of related literature sections that we were to develop were areas that would not be necessarily covered in the Research Design and Development course. The students were very interested in working the two courses into one complete product, which made the course much more enjoyable in nature. Due to the desire of the students to accomplish one task for two courses, the students maintained a desire to accomplish the designated procedures.

The first hurdle was for the students to choose a subject matter. This was a difficult task for most students because they had so many intriguing research ideas; however, once the students focused upon a topic, they were interested in beginning their research process. Unfortunately, one or two students decided upon topics that had little or no research specifically related to their subject matter and were very disconcerted by this fact. Although numerous discussions were held upon the difficulty of locating research directly related to their topics, the students were still quite distracted, confused and worried about this matter. Instead of choosing areas of research at a secondary level upon the topics in question, an example being to research business profit margins and growth ratios along with the growth of World Wide Web usage instead of corporations doing business on the World Wide Web, the students were uncomfortable with this shift and instead chose another topic to research. Once the students changed research area topics and began to find research upon their specific areas, the students felt more comfortable with their progress and caught up to their fellow students in obtaining research at a rapid rate; in some instances surpassing their classmates.

Research

Researching topics was a new experience for most students. Although the World Wide Web was an area which offered a wealth of information and, in some cases research, the students found it a learning experience to delve into the library to locate their research articles that would be of primary importance within their final products. The experience of working through the process of locating relevant research, discerning which articles would be of use in the students' work, and obtaining copies of the articles were learning experiences which were difficult but nonetheless important to work through.

The students found interlibrary loan to be most appealing through out the course. Each time the students could locate an article that was not located in the university library, the students learned that the university library would not only obtain the article for them (i.e., less legwork for the students) but would also copy the article and send it to the designated address (i.e., free of any direct copying charges to the student). From discussions with the students, it became something of a game to the students through out the course to see who could locate the most articles that were available through interlibrary loan and the time it would take to obtain the articles. By the end of the course, the students clearly understood the benefits of the university library and the services the library offers.

Relevant Research

The students located numerous articles upon their topic matter through out the process, but some articles did not specifically pertain to the topic that the student specifically desired to discuss; some of the research did not fit into the schema that the students were developing. Although the students did find the material interesting to read, and tried their hardest to include the material in their papers due to the work the search entailed, the students did discover that some research was not meant to be included in their final product due to the relevancy of the research. Although this was a difficult realization, the students did use the nonrelevant research's references to locate other relevant research through a webbing process. The webbing process consists of using reference lists to locate other research that would be useful to the development of the subject matter.

Subject Matter Research

Subject matter branched off into related areas for each student. Depending upon the topic each student chose and began to focus upon a proposal format, the students soon realized that other, related areas of research, would also need to be included in the review of related literature. For example, a student that was interested in designing and developing a product that would then be tested through an experimental research design would need to not only include the main subject area that the product would be focused upon (for example, Biology and the use of technological Biology programs in a high school classroom situation) but also include instructional design theory, instructional design models, instructional development theory, instructional development models, student-centered software programs, teacher-centered software programs as well as several other possible subject areas. If the students found this idea to be difficult to perceive, fellow students as well as instructor dialogue offered opportunities to build schemas of understanding and outlines to implement an understandable outline model.

A secondary opportunity for students to observe the branching of subject matter within their chosen research topic was located within the research articles. A majority of students located at least one article that closely aligned their developing topic. These articles acted as guides to the students concerning possible areas into which the students could expand their research inquiries. Not only did students have opportunities to expand their research areas while locating and reading through the research, but the students also developed skills analyzing the relevant research they located.

Analyzing Research

Being a newcomer to the university, I was surprised at the depth to which the masters students could not only read research but could analyze the research results and discussion sections. The majority of students were currently taking a Research Design and Development course which would offer a schematic landscape through which an understanding of research results and discussion would arise, but I was amazed at the clarity the students offered concerning the results of the research they located. Knowing that the students were at the masters level and most likely somewhat unfamiliar with the research in the field of information technology, and most likely research articles in general, I was quite amazed at the comprehensibility the students brought to this area of the course. Very little guidance was required for the majority of students due to their level of understanding.

Formatting Issues

The students were unfamiliar with the format that the developing papers should undertake. This was something of a difficulty through out the course, although handouts and samples were made available. Students were advised to purchase *Publication Manual of the American Psychological Association* (American Psychological Association 1994) through which they would follow standard guidelines to complete their project. Although the students did try to follow the guidelines, difficulty arose due to the

unfamiliarity of the guidelines. Due to this difficulty, published theses were distributed for viewing during one of the classes, as well as an online example was made available to the students for perusal. Although the dispersal of the published theses were said to be advantageous to the students, the availability of the online example was felt to be more useful due to the specific questions that arose through out the course.

Reference Guidelines

Similar difficulties to the formatting issues were felt through out the course due to the unfamiliarity of the students with the *Publication Manual of the American Psychological Association* (American Psychological Association 1994) pertaining to the bibliography format. Each reference was included, whether obtained from research journals, World Wide Web, e-mails or other forms of information dispersal. Although sample reference guidelines were presented in handout format as well as available online, the students continued to have difficulties with the formatting through out the course. However, on a positive note, the students diligently worked towards perfecting their bibliography sections and did, in fact, present a faultless final product.

Fear Factor

The most difficult part of the course for the students was overcoming the fear of publishing their work, either in thesis format or submitting an article to a research journal for possible publication. The students had a considerably high, real fear of presenting their work in a public forum. Discussions occurred between students, between students and instructor on a small group level, and as a large group of students stating their concerns and receiving positive feedback from the instructor and other students in the course. Once most students realized that they were, in fact, not alone and were actually joined by the other class members in their concerns, the fear factor dissipated and turned into something of an exciting venture. From observing the conversations and exchange of understanding between students, the students themselves supported each other's efforts and offered encouragement whenever possible. A community of positive support and encouragement arose out of the concerns and fear issues that previously plagued the students at the beginning of the course. Seemingly, such a disconcerting experience brought the classmates closer together and developed a closer bond due to the shared feelings of being in this together.

Feedback

One of the topics the students felt most strongly about while in the course and at the conclusion of the course was the significant feedback that was offered by the instructor. Students were expected to turn in drafts of their work to the instructor so that the students could obtain developmental feedback as well as allow the instructor to check for difficulties or areas of concern through out the course. The instructor made a concerted effort to mark the drafts with an infamous green ink pen so that the students could have solid, significant feedback on areas of strength as well as of concern. From student feedback, this is the area that the students felt to be the most helpful in not only developing their work, but also in feeling secure that they were meeting the course objectives.

Publishing Articles

The students were each expected to develop a thesis paper product as a part of the course. A second expectation was that the students would take the paper they were developing for their thesis paper product and develop it into a scholarly article. The students were required to work through the process of obtaining publication guidelines for journal articles, submit abstracts of their literature review to not only journals but also conferences, and develop an article that could be published in a scholarly journal.

Perhaps the most significant part of the course for the instructor was hearing from the students that their work was accepted to be submitted to a scholarly journal and to be presented at educational

conferences. The pride and surprise in the students' voices and facial expressions was quite clear and offered the instructor a strong sense of accomplishment and pride in the students' efforts.

Conclusions

In summary, the student experiences are a microcosm of experiences felt by each scholar when they write their first scholarly work. All researchers began their scholarly career with very little understanding of numerous issues such as the formatting, reference guidelines, writing voice, and level of work that are deemed to be acceptable and expected within the scholarly community. The difficulties surrounding the progress of masters students from writers to scholarly writers and researchers are ones which must be overcome. Masters students have found certain difficulties through out this process; specifically, the students have found themselves in a quandry concerning such basic issues as understanding the process through which one must travel to obtain relevant research and information upon the subject matter in question, obtaining previous research upon their subject matter, analyzing the obtainable research, formatting issues, reference guidelines and overcoming their basic, undeniable fear of submitting their scholarly endeavors to a wider audience. However, masters students seemingly gain tremendous understanding and positive experiences from the support and guidance of a course surrounding such efforts

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College of Education Faculty Use of Technology: A Snapshot in Time

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Abstract: This paper reports on the findings of a college of education technology survey that investigated faculty knowledge, levels of use, types of use, and perceptions of the importance of technology in teacher education. Data suggest faculty knowledge of and skill with using technology do not necessarily transfer to use of technology in teaching despite the fact that 93.1% of the faculty rated technology in teacher education as "very important" or "important." Time to learn new software and equipment access remain constraining factors to application of technology in teaching. Tenured/tenure-track faculty and affiliate faculty needs and concerns should be addressed as efforts to integrate technology in teacher education programs continue.

Introduction

Colleges of education have a pivotal role in preparing teachers who are able to teach with technology. In *Teachers and Technology: Making the Connection* (U.S. Congress, 1995) education graduates reported feeling inadequately prepared to teach with technology. This is not a surprising situation, given that in most colleges of education, "technology is not central to the teacher preparation experience" (p. 165). Willis and Mehlinger (1996) summarized the topic of technology in preservice education: "Most preservice teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology" (p. 978). Thomas (1992) argued that technology must become "an essential part of America's teacher preparation programs" if it is to be an integral part of K-12 education (p. 9).

In order to assure that teacher preparation programs adequately address technology competencies for preservice teachers, two key elements need to be examined: faculty knowledge about technology and faculty use of technology in teaching. NCATE's 1995 *Standards, Procedures, and Policies for the Accreditation of Professional Education Units* included a new indicator under faculty qualifications which states that "faculty are knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship" (p. 24).

The Study

This study investigated how technology was being used by faculty in one college of education (COE). The following six research questions were addressed:

1. What are the current levels of faculty knowledge and skills regarding specific types of technology?
2. Which technologies do faculty use in preparing for and in teaching classes?
3. What level of importance do faculty give to technology in teacher education?

4. What factors inhibit faculty use of technology in teaching?
5. What are the primary concerns of faculty in using technology in teacher education?
6. What assistance do faculty perceive is needed to facilitate integration of technology in their teaching?

A survey (available online at http://www.nevada.edu/~strudler/survey.html) was designed by the principle investigator with assistance from a research specialist in the university's Center for Survey Research. Drawing from research by Spotts and Bowman (1995), Vagle (1995), and Wetzel (1993) current issues regarding college/university faculty use of technology were included in the survey. Two faculty members with expertise in survey research reviewed it, and the survey was tested for item clarity with doctoral students in a seminar class. Two additional faculty members with expertise in educational technology reviewed the survey and the final version was examined and approved by the survey research specialist. In January 1997, the survey was distributed to full-time, tenured/tenure-track faculty (n = 66) and to affiliate faculty including part-time faculty and lecturers who were not in tenure track positions (n = 80). The number of completed surveys returned was 87 for an overall return rate of 59.6%.

Descriptive statistics provided data concerning faculty knowledge, skill, and use of technology in preparing for and in teaching class. Data were analyzed with mean, median, and mode calculated for appropriate items, and tables and graphs were constructed for visual comparison of information gleaned from selected survey items.

Faculty concerns about the integration of technology in teacher education were elicited through an open-ended item, "When you think about the integration of technology into teacher education, what are your concerns?" Responses were categorized based on the Stages of Concern (SoC) model (Hall & Hord, 1987). SoC describes seven levels ranging from 0 to 6: (a) Awareness = 0, (b) Informational = 1, (c) Personal = 2, (d) Management = 3, (e) Consequence = 4, (f) Collaboration = 5, and (g) Refocusing = 6. The SoC model was designed to help analyze concerns experienced by teachers as an innovation is being adopted, thereby increasing the likelihood of providing appropriate assistance or reassurance to alleviate those concerns. On the survey, some COE faculty responses reflected concerns that corresponded to more than one stage and they were coded into multiple categories. Each coding was counted as a separate response, making the total number of responses (n = 99) greater than the number of faculty (n = 87). Rating reliability was established by having a peer also code the responses and agreement was 94.0%.

After rating the importance of technology in teacher education, faculty were asked to expand on reasons for their ratings in an open-ended survey item. Categories were created for coding the responses and intercoder reliability was 90.8%. Responses sometimes fit more than one category and were coded accordingly, therefore, the totals for expanded reasons (n = 108) were greater than the number of participants (n = 87).

Findings

Results of the survey provided data to describe the overall use of technology by COE faculty. Of particular interest in this study were faculty knowledge, skill levels, and use of computer-based technologies in preparing for and in teaching classes. Means for ratings of skill levels for using various computer-based technologies (i.e., word processing, computer spreadsheets, statistical computing, e-mail, educational software, presentation software, Internet/World Wide Web, and multimedia) as reported by faculty were only slightly lower than means for their ratings of knowledge levels about those technologies (see Fig. 1). Faculty selected from a Likert-type scale: a) No Knowledge = 1, b) Very Little Knowledge = 2, c) Some Knowledge = 3, and d) Extensive Knowledge = 4.

Faculty rated their knowledge and skill levels highest with word processing and e-mail, and indicated these two technologies were used most frequently in preparing for class. However, the frequency of use of word processing or e-mail in teaching class was lower. Means for each of the other technologies reflected little use in teaching as displayed in Fig. 2. Frequency choices on the Likert-type scale were a) Not at all = 1, b) Once during Semester = 2, c) Monthly = 3, and d) Weekly = 4.

Survey data separated by tenured/tenure-track faculty and affiliate faculty showed use of technology in teaching was infrequent for both groups. At least 70% of the affiliate faculty and 50% of tenured/tenure-track faculty indicated no use of the various technologies in teaching with the exception of educational software which was used by nearly two-thirds of the tenured/tenure-track faculty.

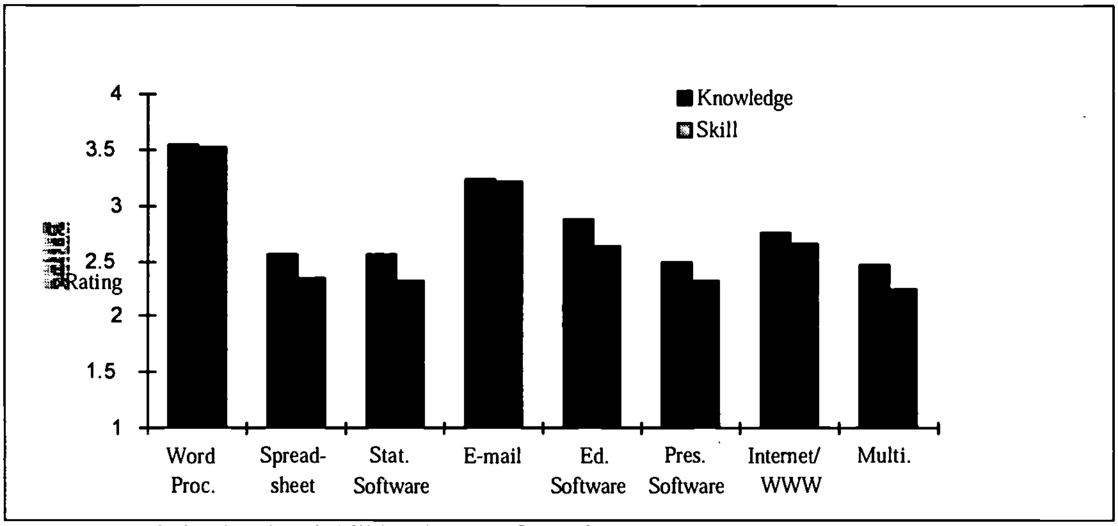

Figure 1: Knowledge level and skill level means for various technologies.

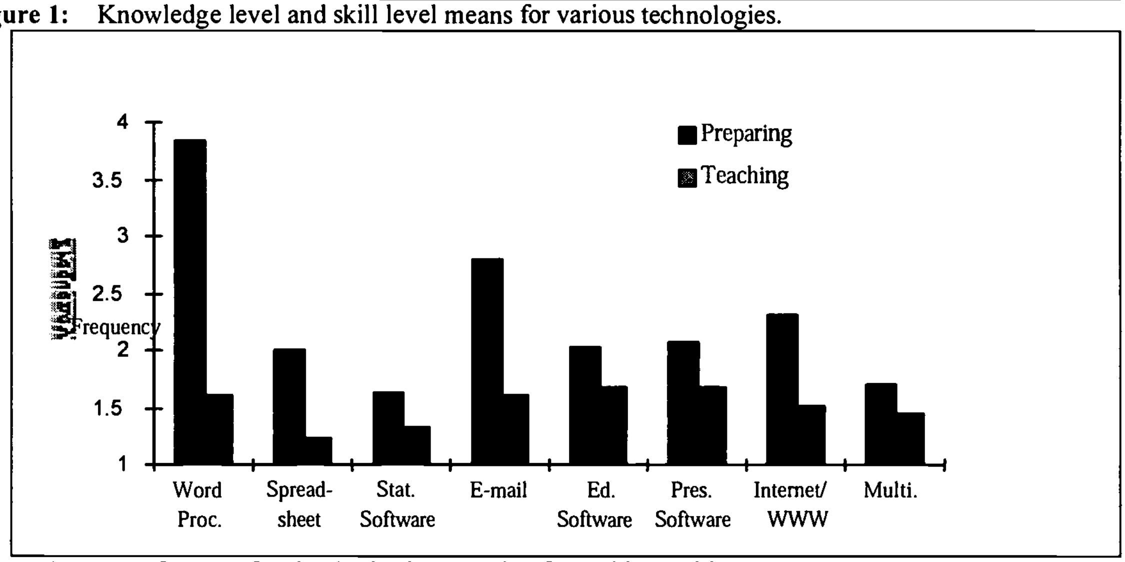

Figure 2: Means for use of technologies in preparing for and in teaching class.

When asked about the importance of technology in teacher education, both tenured/tenure-track faculty and affiliate faculty responses were similar. Survey data suggest that faculty (n = 87) believed technology integration in teacher education was important, with nearly two-thirds of the faculty selecting "Very important" (see Fig. 3).

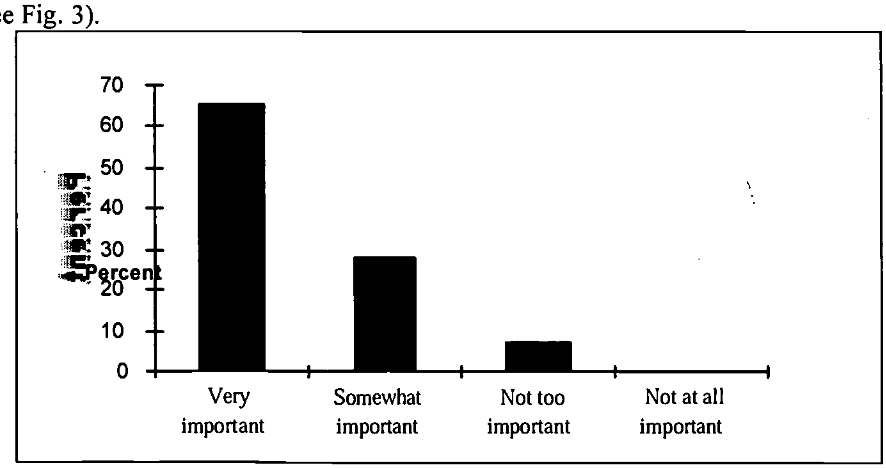

Figure 3: Faculty ratings of importance of technology in teacher education.

Many responses of survey participants supported the importance of technology in teacher education with statements reflecting the idea that technology is a part of the modern world or important to the future. A greater percent of affiliate faculty responses related the importance of technology in teacher education to being a part of the modern world or important to the future. The category of "other" included responses that did not explain the importance rating such as "It is important and I need to do it" (see Tab. 1).

Category	Responses of Tenured & Tenure-Track Faculty (n = 61)	Responses of Affiliate Faculty (n = 47)	Total Responses (n = 108)
Modern world/future	23.0%	36.2%	28.7%
No response	16.4%	19.1%	17.6%
Teaching/learning tool	18.0%	12.8%	15.7%
Other	14.8%	8.5%	12.0%
Modeling	9.8%)	12.8%	11.1%
Information/Communication Age	13.1%	4.2%	9.3%
Social/economic issues	1.6%	6.4%	3.7%
Research	3.3%	--	1.9%

Table 1: Frequency of expanded reasons for importance of technology in teacher education.

Survey respondents were asked to select the primary factor that inhibited their use of technology in teaching. "Time to learn new programs" was the overwhelming factor selected by 44.0% of tenured/tenure-track faculty and by 24.3% of affiliate faculty. "Obtaining equipment for use during instruction" was selected as the primary factor by 18% of tenured/tenure-track faculty and by 27.0% of affiliate faculty (see Tab. 2).

Factor	Tenured & Tenure-Track Faculty (n = 50)	Affiliate Faculty (n = 37)	Total Respondents (n = 87)
Time to learn new programs	44.0%	24.3%	35.6%
Obtaining equipment for use during instruction	18.0%	27.0%	21.8%
No factors restrict my use of technology in teaching	14.0%	13.5%	13.8%
I am not aware of the technology resources available	4.0%	16.2%	9.2%
Something else	12.0%	2.7%	8.0%
Technology will not enhance my subject area	2.0%	8.1%	4.6%
The COE does not have the software I need	4.0%	--	2.3%
Hardware/software changes are too rapid to keep current	2.0%	2.7%	2.3%
I find technology frustrating to use	--	5.4%	2.3%

Table 2: Frequency of factors inhibiting faculty use of technology in teaching.

A survey item regarding preferred arrangements for learning new things about technology is summarized in Tab. 3. "One-on-one assistance" was ranked as the first choice by both faculty groups, with 50.6% of the total respondents indicating a preference for that arrangement. The relationship between preference for one-on-one assistance and frequency of technology use in teaching was explored. Of respondents indicating no use of the various technologies in teaching (i.e., word processing, computer spreadsheets, statistical computing, e-mail, educational software, presentation software, Internet/World Wide Web, and multimedia), 60% or greater also selected one-on-one assistance as preferred.

Arrangement	Tenured & Tenure-Track Faculty (n=50)	Affiliate Faculty (n=37)	Total Respondents (n = 87)
One-on-one assistance	52.0%	48.7%	50.6%
Figuring things out alone	26.0%	16.2%	21.8%
Workshops	14.0%	29.7%	20.7%
Using manuals or other published materials	8.0%	5.4%	6.9%

Table 3: Frequency of preferred arrangement for learning new things about technology.

Faculty concerns about integrating technology in teacher education were coded using the SoC model (Hall & Hord, 1987) and then grouped into three main levels, (a) awareness, (b) management, and (c) impact. Statements showing little concern or involvement with technology in teacher education were coded as awareness, and blank responses were included in this stage. The awareness level accounted for 33.3% of faculty concerns when awareness concerns (20.2%) were combined with informational concerns (1.0%) and personal concerns such as fears about failures or personal ability (12.1%). Management level concerns refer to issues about resources, access, efficiency, organizing, managing, scheduling, and time demands. Survey results showed 33.3% of faculty concerns were management level. Concerns grouped at the impact level look beyond personal concerns and equipment. Impact level concerns include consequence, collaboration, and refocusing stages. Of the faculty responses, 24.2% were consequence concerns, no responses reflected collaboration concerns, and 9.1% were refocusing concerns. Responses grouped at the impact level represented 33.3% of faculty concerns (see Tab. 4).

Stages of Concern	Faculty Responses (n = 99)	Level	Percent of Concerns by Level
(0) Awareness (1) Informational (2) Personal	20.2% 1.0% 12.1%	Awareness	33.3%
(3) Management	33%	Management	33.3%
(4) Consequence (5) Collaboration (6) Refocusing	24.2% -- 9.1%	Impact	33.3%

Table 4: Frequency of responses categorized by stages of concern.

Conclusion

In analyzing survey data, it is clear that faculty believe technology in teacher education is important. Faculty also indicated high confidence levels in their technology knowledge and skills, yet they are not implementing use of technology in their teaching. Rogers (1995) contends that "knowing about an innovation is often quite different from using a new idea" (p. 167).

Time and equipment concerns, frequently cited as factors that inhibit use of technology in education (Barron & Goldman, 1994; Carr, Novak, & Berger, 1992; U.S. Congress, 1995; Wetzel, 1993), constrain COE faculty use of technology in teaching. In considering the time issue, benefits of learning new software need to be perceived as compelling enough to balance the time costs. With NCATE unit standards as the basis, expectations for faculty use of technology in teaching should be conveyed and modeled by the administration and evidence of use should be required and rewarded in yearly evaluations.

In some cases, faculty do not know how to implement technology to enhance instruction or to help accomplish course goals. Affiliate faculty indicated a higher preference for workshops than did tenured/tenure-track faculty who would rather figure things out alone. Both faculty groups indicated a strong preference for one-on-one assistance when learning new things about technology. This type of technology support requires individuals with technical expertise and strong interpersonal skills (Strudler, 1995-96). Knowledge of software, and of strategies for teaching with technology are important also.

Efforts to integrate technology in this COE focused on tenured/tenure-track faculty, with workshops and support more readily available to them than to affiliate faculty. It cannot be assumed that the needs of tenured/tenure-track faculty and affiliate faculty are the same. Despite the fact that affiliate faculty are teaching increasing numbers of college courses, they struggle with obtaining equipment and lack of knowledge about available resources in the COE. The importance of working with affiliate faculty, assessing needs, disseminating information about technology resources, and providing professional development opportunities is evident. Since many colleges of education depend on affiliate faculty to deliver some of their courses, ongoing support for their technology use in teaching is essential for integration of technology throughout teacher education programs.

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A Deeper Psychology of Technology: A Case Study of a Girl and her eMate

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A Need for a Deeper Psychology

In an article entitled, "The Learning Effectiveness of Educational Technology: A Call for Further Research," Jones and Paolucci make the claim that "a missing component of justifying the expansion of technology in educational delivery is the establishment of research agendas using formal research methodologies" (Jones & Paolucci, 1998). The evidence to support their claim comes from a three-year study of 8 major refereed educational technology journals. The survey shows that only about 18% of all technology research completed addressed an evaluation of learning outcomes. A majority of the articles revolved around technology applications, development, or implementation.

Jones and Paolucci's article, as well as their survey, points to a current trend in educational technology research programs--that of focusing solely on the cognitive domain in the relationship between technology and learning. This is not to suggest that measuring learning outcomes of technology use is an unnecessary or fruitless endeavor, only one with inevitable limits. There is a plain, one might say urgent need for a more complete approach to research on technology integration.

The problem with this trend in educational technology (often situated in educational psychology programs) is the disappearance of research addressing the affective domain of technology use. The statistics in the survey point to an almost extinct population of articles relating to affect. There have been a number of articles which have attempted to break out of the cognitive domain by asking questions about perceptions, attitudes, and motivation in using technology (Lepper and Hodell, 1992; Cordova and Lepper, 1996). Many others have ventured into the affective domain only in so far as it helps to explain cognitive gains. Although these studies are leading the way for creating a new set of research tools, we must continue to focus on gaining a more complete psychology of technology.

Clifford Geertz (1973) argues that we need "thick descriptions" in order to better represent and understand human experience. And in his famous essay "Deep Play" (1973), he supplies a timely metaphor for a new field like educational technology. Applying this metaphor of "depth" to educational technology essentially means opening it up to all of the tools available to us as psychologists rather than technologists. There are a number of psychological questions that, although normally associated with developmental psychology and psychoanalysis, may prove fruitful in our discussion of a "deeper" educational technology. Questions include the role of emotions through technology, mediating relationships with technology, and sense and meaning-making through technology. Many of these questions fall outside of the realm of the cognitive domain.

This paper argues that the limits of current tools in educational technology research may obscure for researchers and (perhaps more importantly) teachers what is happening in the classroom. It may also deny them the necessary tools to explain phenomena they encounter in the classroom and in the lives and minds of the subjects of their studies. Research is also presented as an example in which a broader and deeper view of educational technology affords a more complete understanding of technology integration. The paper concludes with suggestions for achieving depth and completeness in educational technology research. It is hoped that this revised perspective towards technology and education will aid researchers and teachers in their understanding of technology innovation implementation.

Computers in an area elementary school

In the summer of 1997, a team of graduate students and faculty of a large, public Midwestern university began a project to implement technology into special education and inclusion classrooms at a local elementary school (Author, 1998). As part of the project, the team decided to purchase an eMate for each of the three classrooms in the study. (An eMate is an Apple product, a grandchild of the popular Newton series.) There were two main reasons for the purchase. First, special education children can sometimes have a hard time typing on the computer. It was felt that if they had an opportunity to write on the screen, a technology the eMate affords, they may be more motivated to practice spelling, write stories, and read works to their colleagues and teacher. Second, the eMate is fun to use. The team thought it would be interesting to see how the children reacted to new and exciting technologies in the classroom.

Shortly after the eMates were introduced, a team member had a conversation with one of the students. Sarah, labeled by the school psychologist as "Educable Mentally Impaired (EMI)", was a fourth grader at the school who had bonded with her computer. She used the eMate whenever she was required to complete a spelling test on a computer (she also had the choice of one of the "bigger" computers). The eMate was also utilized to write stories when Sarah had free time. From a cognitive perspective, Sarah made tremendous improvements over the course of the year. Her reading test scores as well as her general classroom scores improved. The original research questions were aimed at discovering how much of this improvement was associated with technology use. However, there was much more to Sarah's story than mere test score improvements.

Sarah and her computer "Brian" became friends. The bonding could best be described as an intense, human-like experience. Not only did she talk to the computer (and assure the team members that it talked back), but she also named him and took care of daily needs such as its feeding. The integration project was supposed to help special education children with the development of literacy skills. The eMate was going to assist in that goal by helping children learn to type, write stories, and spell better. The initial research questions that were situated in a cognitive domain, however, had nothing to offer the research or the researchers when presented with a young girl hugging a computer.

At first, the teacher and the team member considered the situation nothing more than an interesting phenomenon. However, Sarah's relationship with the eMate became

more striking when she began using it to mediate relationships both in and out of school. In the classroom, she was one of the only girls in the resource room. She did not get along with many of the boys, complained often about the lack of girls, and yet decided to have her computer "be a boy." "Sarah needs to control things" her teacher commented. "This may be her way of controlling the situation with the boys in the class."

School was not the only environment in which Sarah mediated with the eMate. At a party during the school year, her aunt was murdered. She told us that she could not tell Brian about the death because "it would cry." She spent much of the next few weeks after the death without Brian. It took her quite a while to learn how to tell "it" what had happened.

Sarah was a poor student and was going through some pretty difficult times. However, she was not only able to maintain her composure, but she was even able to better herself as a student and as a person (both her teacher and her mother commented on her improved behavior). The only major change between the first semester and the second was the introduction of the eMate. How did the relationship between the eMate and Sarah facilitate this growth?

Initially, some of the team members wondered whether this type of situation was similar to a child having an imaginary friend or a doll. The eMate was a safe tool for Sarah. All of the students knew the importance that the teacher and visitors from the university had placed on technology. Her classmates, peers, and instructors would treat her with more leniency with a technology in the classroom than they would with something she brought into the classroom on her own. But, how did this differ from the actual psychological use of a blanket, doll, or imaginary friend? Trying to further understand these happenings, we turned to psychology and the influential British developmentalist D.W. Winnicott (1896-1971).

In his widely cited "Playing & Reality", Winnicott (1971) suggests that infants, children, and even adults make use of "transitional objects." Transitional objects are objects or phenomena that are related both to external and internal reality. "This intermediate area of experience, unchallenged in respect of its belonging to inner or external (shared) reality, constitutes the greater part of the infant's experience, and throughout life is retained in the intense experience that belongs to the arts and to religion and to imaginative living, and to creative scientific work" (Winnicott, 1971). Sarah used the eMate as a transitional object between her internal reality and the reality that existed in the classroom and at home.

Viewing the eMate as merely a computer used for spelling tests, even if it was important in her obtaining higher reading scores, one would have missed the "thicker description" of what was really happening and thus a more probing psychological account. This application from Winnicott is but a small sign of the potential uses of psychological ideas in the study of educational technology. Both the teacher and the research team were better able to understand the cognitive gains Sarah had made by uncovering the affective uses of her eMate. Furthermore, they were able to better plan future educational activities understanding what Sarah was bringing with her to the learning event.

However, stopping at the point of reinforcing or better understanding cognitive gains may mean missing a more complete picture of the study. Coming to terms with how Sarah was using the eMate also helped the teachers and researchers better

comprehend her emotional development and how to foster her emotional and social growth in the classroom. As the teacher said, "I now better understand how to reach Sarah." Drawing on the experiences in the social life of the classroom, the teacher was also better able to help the parent grasp the social and emotional mediations her daughter was making at home.

Finding the Right Words

Contemporary educational technology research has argued for more systematic and ambitious studies of the effects of technology implementation into the classroom. However, the major trend within this field of research has been to focus solely on the cognitive domain of the relationship between technology and pedagogy. Research is missing reflecting other domains of inquiry, and thus, we do not have the accounts we need of the emotional and social development of students new to educational technology.

This paper presents a case study in which a student used a technology to mediate control within her school and home life. Initial research questions focused on a cognitive change and addressed improvements in reading scores. However, it is the return to a deeper psychological vocabulary that provides more complete insight into the cognitive and other gains made by a student. Further, it presents the researchers, the teacher, and the parent with a set of tools to scaffold the development of the child on multiple levels: social, cognitive, developmental, and affective.

The task of technology-focused, educational psychologists and teachers, then, is not only to establish more structured research and teaching agendas, but also to expand the terminology within those inquiries. For instance, object relations theory states that the individual's psychological life is created in and developed through relations with others (Stevens, 1998). How might Sarah's story be perceived realizing that the eMate helped her mediate relations with her friends, peers, and family? Narrative psychology, contends that meaning is made of one's life through the stories told and re-told about the events and experiences in their life (Bruner, 1996). How has Sarah's story changed as a result of the relationship with the technology? Finally, cultural psychology says that the tools a person learns to mediate with are both enabled and constrained by the society and culture of which they are apart (Cole, 1996). What were the different views that the researchers and the student had of what the artifact was meant for?

We return to Jones and Paolucci's initial petition for more invention in educational technology research. Thus, this paper will offer a retelling of Sarah's story, using the complementary approaches offered by Bruner, Cole, and Stevens. Valuable ideas, terms, and concepts in psychology and other disciplines can then be coordinated with what cognitive psychology supplies to the kind of situation of which Sarah is representative. For it is only through this integration that we will have a more multi-layered and complete understanding of pedagogy and technology.

Muffled Voices: Teachers' Concerns Regarding Technological Change

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Abstract: Successful integration of technology is seldom serendipitous. Successful infusion of technology is dependent on the thoughtful plans, strategies, and provisions developed by knowledgeable educators to meet the needs of their students. Advances in technology and its increasing availability in K-12 schools make it incumbent upon administrators and teachers to make use of today's technology-related learning tools. This paper presents teachers' accounts about their efforts and vexations regarding integrating technology into classroom practice. Unfortunately, many teachers feel their voices have not been heard by the organizational culture. The authors give voice to teachers' concerns regarding issues such as training, arrangements for facilities, security policies, management strategies, and procedures for technical support. Additionally, the paper focuses on pertinent issues and considerations resulting from actual situations experienced by classroom teachers and administrators in their attempts to infuse technology in their schools.

Not long ago, most administrators and teachers could easily ignore the computer revolution and disregard the technological advances that had drastically impacted and changed business and industry. However, the infusion of technology into educational settings has now been identified as a national priority, and many states, supported by the United States Congress, the President, and state legislatures are mandating the use of computer related technologies. Although critics argue that schools are rushing to jump on the latest education bandwagon, it appears evident that educational environments cannot survive without implementing electronic media and instructional technologies. Indeed, today's schools are in a period of transformation.

Technology Demands Change in Schools

Peter F. Drucker (1995), one of the most respected management thinkers of our time, stated "It is a safe prediction that in the next fifty years, schools and universities will change more and more drastically than they have since they assumed their present form more than three hundred years ago, when they reorganized themselves around the printed book" (pg. 79). These changes are being driven by a number of forces which include recent innovative technology such as multimedia microcomputers, DVDs, CD-ROMs, interactive distance learning and virtual reality capabilities; by the demands of federal/state politicians and business leaders; and certainly, by the demands of our present day knowledge-based society. Increasingly, parents, boards of education, and district and state education departments expect administrators and teachers to make use of today's computer-related learning tools.

Millions of dollars have recently been allocated on federal, state, and local levels to equip schools with technologies which will change their very structure. Today's technological changes are not simply limited to the delivery of instruction. That is, the advent of standalone microcomputers has placed the

power of technology directly in the hands of educators, and the image of technology has shifted from replacing teachers to supplementing and enhancing teacher-based instruction (Roblyer, Edwards, & Havriluk, 1997). This paradigm shift holds important implications for educators, for although no one can be sure what the future will bring given the complexity of technological advancements, administrators can assuredly predict that they will be responsible for developing sound technology strategies and shared leadership plans with teachers to integrate technology related tools into the curriculum.

Administrators and Teachers As Technology Leaders

According to the seminal Rand Corporation Change Agent Study, administrators must evidence support for technology, or technology innovations will be ignored by teachers (McLaughlin & Berman, 1977). Therefore, if educators are to succeed with the increasingly complex task of technology deployment, they must ensure that technological change has a broad base of support and that leadership is a shared endeavor. "Success with technology is rarely serendipitous. Certain clear factors profoundly affect whether technology helps education take a leap forward or a pratfall" (Roblyer, Edwards & Havriluk, 1997, 28).

It could be argued that most teachers and administrators are struggling to understand their respective roles and responsibilities in an attempt to justify the expensive and time-consuming task of integrating technology into today's classrooms. This is not surprising since the educational institution as a whole clearly has not understood nor addressed many of the external forces that have driven the development of new technologies. It is a given that educators are in a difficult position to serve as technology leaders for their schools; however, for administrators the human dynamics of integrating technology impose one clear imperative: they must listen and respond to teachers' concerns about the technological venture. Based on our experiences, interactions, and informal interviews with teachers, the following recurrent themes appear to be central to teachers efforts and vexations regarding integrating technology into classroom practice. A primary purpose of this paper is to give voice to teachers concerns.

Training for Teachers and Administrators

Experts in the field of technology acknowledge that technology involvement can pose an intimidating challenge under the best of circumstances. Most teachers and administrators feel threatened by this challenge because it represents a journey into the unknown, and they know that they are inadequately prepared. "If technology is to be widely used, teachers and administrators need training. Training to use technology must be a part of every entry-level teacher's preparation and should continue throughout a teacher's career so that he or she can keep abreast of developing technologies" (National Governors' Association, 1991). The teacher's role is a critical factor in the use of computers in the classroom (Office of Technology Assessment (OTA), 1995). As Hebenstreit noted:

> It has been said that computers can improve education if they are used at the right place, at the right time, with the right amount and in the right way, but to meet all these conditions teachers have to be trained to use the computer that way. The mere presence of computers in schools does not guarantee that education will be improved.... (1992, p.59).

Administrators must be advocates of educators' training due to the fact that teacher training in the use of computers is absolutely essential. Without endorsement by teacher practitioners, the utilization of computers in education will not occur (Hebenstreit, 1992). In the nationwide OTA (Office of Technology Assessment) study of the use of technology in education, lack of training and limited knowledge about computers were the most commonly cited reasons for non use of computers (Office of Technology Assessment, 1995). Recent studies continue to report that properly trained teachers make the difference between success or failure of technology integration efforts (Siegel, 1995).

A school-site technology lead teacher explains, "Teacher do not want to get training because they are so angry about the way computers have been shoved in their classrooms. They have not been involved in the planning process, and no one has even asked teachers if they wanted computers! Computers are being dumped in classrooms without even tables to put them on." A high school English teacher stated that

most teachers in his building are still struggling with the basic skills needed to operate the computers. He refers to these educators as "teachers with two hands on the mouse." They can not "drag and click" let alone use software programs for instruction.

Unfortunately, many school systems have spent their technology budgets largely for the purchase of hardware and software. Teachers have been instructed to "learn on your own," after attending one-shot inservice sessions. Teachers are frustrated because learning computer skills requires the ability to absorb so many different concepts and also requires a great deal of time to practice and experiment before they feel confident enough to involve their students. One veteran teacher explains, "Years ago most teachers would not show movies in their classrooms because they did not know how to thread the movie projector. The situation with computers is just the same; however, the financial investment is much greater."

Research indicates that most school districts spend less than a quarter of their computer budgets on training (Bruder, 1993). Therefore, the rate of hardware and software acquisition has continuously out-paced the rate of computer-related professional development. Perhaps rethinking budget priorities for professional development is long overdue

Teachers are being told to create a school environment that integrates new technologies requiring radical changes in their teaching strategies (Collins, 1991), and yet, teachers justifiably complain that their districts will not provide the training, money or resources necessary to initiate such sweeping changes. The teachers' complaints range from "the district will not purchase user manuals or training programs because they are too expensive" -- to being told to "purchase needed software with their own money because they can get an educator's discount." Teachers have also been directed to "request whatever they need for technology implementation... but remember that these purchase requests have to come out of the regular instructional budget." This administrative double speak has served to thwart teachers' efforts while all the talk about the Information Superhighway falls increasingly on deaf ears. The point is clearly stated by teachers when they contend "[They] will not be responsible for implementing technology without first being well trained and provided with the necessary resources."

School Facilities

Although schools may not presently be able to attain ideal facilities for technology equipment, each school should identify the physical facilities needed in a technology plan so that educators can develop a list of priorities that will help them obtain these needed arrangements. The question most teachers (especially elementary) are asking is "Now that we have them, where do we put them?" One first grade teacher stated:

> I'm not going to give up my reading circle space just so the administration can unload computers in my room. The rule in my school now is five computers in every classroom. It would make better sense to have one computer in each room and set up a computer lab for the entire school to use. Someone better tell me, too, where to store all the manipulatives we have purchased for the children. There simply is not enough space to fit everything.

The classroom of yesterday, although adequate for housing thirty students in five straight rows, is inadequate for containing those same thirty students who now require computer workstations in order to perform the gamut of todays technological tasks. Spatial arrangements for equipment and traffic flow, furniture placement, and power outlet sources have become a concern for teachers in most schools. For example, in older buildings where conduit is not available, wires on the floor are invitations for student and teacher injuries. Stuffing students and equipment into small rooms also increases the chance of equipment breakage, greater discipline problems, and frayed nerves on the part of teachers and students due to the lack of individual space. Teachers are very concerned about these physical facility issues as well as issues related to security.

Security Requirements

Many teachers resent the all-encompassing warnings several administrators have made such as "You're responsible for stolen equipment, vandalism, viruses, and equipment breakage." Some teachers have felt so threatened by these statements that they deliberately resist using technology equipment. They

believe it is unfair to place such undue responsibilities and burdens on them. Teachers recognize that computer viruses are as widespread as the common cold and that protecting equipment from being stolen or damaged is a common problem in most school districts. Teachers acknowledge that this is a shared concern for a school system, but they contend that administrators should bear the major burden of this responsibility. Teachers have stated "School boards and administrators should know that these things will happen - we just do not want the finger of blame pointed at us when it does." Administrators are in the position to establish requisite procedures and policies that address these security issues. Security precautions can be a costly expense; however, they are usually more cost effective than replacing stolen or vandalized equipment. Sadly, just as home security systems have become essential, school security systems appear to be imperative.

Management for the Acquisition of Supplies

Teachers are increasingly concerned about the availability of consumable technology supplies (e.g., toner, ink cartridges, videotapes, diskettes) as well as the lack of available technology accessories (mouse pads, copy holders, diskette containers, computer covers, printer stands, switch boxes). Running out of sticks of chalk in yesterday's classroom was one thing (you could always find broken pieces); however, running out of toner completely shuts down the technological operation in today's school. A media specialist shares this account:

> Our school houses a $4,500 laser printer; however the toner for the machine is kept at the central administration building. Whenever the laser printer runs out of toner, it takes three days to get a cartridge from the administrative office. Teachers have learned to remove the depleted cartridge from the machine and shake it in hopes of printing a few more copies, but that only works for about two more times. The bottom line is 'tough luck' if you need anything printed. What upsets the teachers is that they have been told by the administration to work around the problem. It is really frustrating for teachers when they are in the middle of a project or tests need to be printed!

This situation is not limited solely to printing demands. A similar story about another supply, VHS tapes, is related by a media specialist from a rural school system:

> Our school system owns a satellite dish... so the teachers requested that the feed be taped for use in the classroom. The joke is that our school has state of the art video recording equipment but blank video tapes were not purchased to record programs. The reason the administrator gave us was that video tapes were too expensive for the school to buy. So, he suggested that if teachers wanted this service, they would have to purchase VHS tapes with their own money.

Administrators must anticipate and make budgetary provisions for continual expenditures of consumable technology supplies. Indeed, making these projections is difficult because baseline purchasing data on new technologies is non-existent or incomplete. However, there is one sure point to remember - as the integration of technology increases within the school, the amount of consumable supplies and accessories necessary to sustain this effort also increases proportionally. It is recommended that administrators establish permanent line items for technology expenses in the school's budget rather than lumping these expenditures under yesterday's instructional budget umbrella. Budgeting an adequate amount of money for consumable and accessory technology needs is just part of the total cost for technology implementation. Another major administrative financial pratfall is allocating money for the maintenance of technology.

Maintenance Needs

Because of the sophisticated nature of today's computer and technology systems, educators cannot be expected to solve complicated equipment malfunctions and maintenance problems. One of the cardinal rules technology specialists stress is "Do not tamper with the control panels on the computer, unless you fully know what you are doing." Recklessly clicking commands, changing passwords, and altering subscriber number codes are sure ways to guarantee greater functioning foul-ups. Intentionally hammering on the tops of computer platforms, forcing disks in hard drives, and attempting "to fix" computers without proper training or tools are proven ways to ensure hardware damage. One library specialist shared an

account about a teacher lab coordinator who attempted to repair a cracked plastic casing on a dot matrix printer by using super glue. Unfortunately, "He not only glued the crack in the plastic cover of the printer, the glue seeped into the interior of the machine and froze the printers gears. If this mistake was not great enough, the administrator had the dot matrix printer repaired, and the cost of fixing this outdated printer almost exceeded the cost of purchasing a new, upgraded ink jet printer."

Many of these problems can be avoided if administrators develop proactive policies to prevent such disasters. Administrators should not falsely assume that there will be few technology-related problems, nor that equipment malfunctions can be solved by their faculty or staff. School districts must develop maintenance contracts with outside agencies or set up an in-system department and hire special technology personnel. The overwhelming majority of teachers simply do not possess the technical skills necessary to guarantee that technological equipment will be operative.

Selecting one maintenance option over another (out-sourced versus in-system) is a difficult administrative decision, and teachers report that there are problems and limitations with both methods. For example, an educator who teaches in an out-sourced system explains:

> Our maintenance contract provides for technical support one day per week. There are six buildings in my district, including the administration building, and each and every week at least one of the schools loses out. The tech rep always attends to the needs of the administration building first, so they never experience a one or two week delay. The administrative office fails to realize how angry and disappointed the teachers are at the non-serviced buildings.

Teachers also dislike filling out technical support requests on triplicate forms, being told to schedule appointments with tech reps (as though they can schedule the breakdowns of their computers), and being warned not to talk to tech reps when they are servicing equipment in the building, because the reps are getting paid by the hour. Some schools have tried alleviating some of these problems by designating one teacher per building to act as a technical liaison with the contracted company. This arrangement has been fraught with difficulties, too.

Teachers who serve as technical liaisons find themselves in the unenviable position of providing troubleshooting and stopgap maintenance for their colleagues. They complain because generally they are not reimbursed for this service, oftentimes tech reps do not return their calls in a timely fashion, and they are frustrated with trying to maintain current information about so many different computer hardware systems and software. One special education teacher who also serves as a technical liaison comments, "I rarely ever get through a day without a student coming up to my room bearing a request from a fellow teacher for immediate help with a computer problem. These interruptions are troubling given I teach developmentally handicapped and learning disabled students, and there is no way I can leave my classroom unattended even for a few minutes. Teachers just have to wait until the end of the day for my assistance, and that does not help them when their computer has frozen."

Teachers have also attempted to alleviate some of these technical problems on their own by contacting the technical support division of the computer and/or software company. Dial 1-800-(computer) Help! is a frequent byword in many schools. However, teachers report that being placed on hold when they make these calls or being asked to read what is on the computer screen can cause considerable difficulties when the school's phone is located in the principal's office and their computer is on the third floor of the school building. Teachers exclaim, "School systems lack basic technology equipment such as portable phones!" These procedures appear to most teachers to be poorly considered and uncoordinated approaches for technology maintenance.

Some school districts choose to hire their own technicians and establish internal offices to manage technology maintenance needs and support services. However, as both teachers and technicians relate, this technical support measure is not a panacea either. Teachers lament that "the salary of a technician is often much higher (usually double) that of a teachers salary, and that technology specialists know nothing about the instructional needs of educators." Many school systems also report that the turnover in technical support personnel is high and that it is difficult to hire persons who possess both technical competency and interpersonal skills, and who also prefer working in a school rather than a business environment.

Conclusion

The implementation of technology into today's schools requires both administrators and teachers to be technology leaders. However, studies show that most administrators are not promoting the integration

of technology into the school curriculum (Waxman & Huang, 1993). If administrators are to lead their schools forward, they must address teachers' concerns which are central to integrating technology into classroom practice. Issues such as training in technology, arrangements for facilities, space for technology equipment, security policies to guard technology investments, management strategies for the acquisition of technology supplies and accessories, and procedures for technical maintenance and teacher assistance are some of the major factors that impact the failure or success of technology implementation.

The ability of teachers to integrate technology into instruction is directly tied to the organizational environment and educational culture in which they work. Thoughtful administrators realize that the daily challenges of teaching work against technology implementation (time, training, resources, technical support). Administrators certainly can help teachers if they are willing to listen to teachers concerns about technology implementation, and provide innovative shared leadership to circumvent the constraints of the educational system. Just as the proper use of technology requires significant changes in how teachers teach, the successful implementation of technology into schools requires administrators to make significant changes in how they support their faculties.

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A Qualitative and Quantitative Evaluation
Innovative Use of Internet Based Collaboration

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Abstract

The descriptive study has two phases. The first phase describes the mechanism for on-line collaboration. The second phase quantifies collaborative interaction. The coding design was partially based on ProjectH, a research study from 1992-1994 involving a large number of collaborators from several countries who worked together to study world wide collaborations on the net. Sheizaf Rafaeli, Hebrew University of Jerusalem, Israel and Fay Sudweeks, Key Centre of Design Computing, University of Sydney, Australia coordinated ProjectH. This current study looks in depth at the interaction of ten graduate students who communicated through the German based system, Basic Support for Collaborative Workstation, (BSCW) during one month, September, 1998. E-mail messages from Internet based students were also coded. Final observations were made regarding student interactions throughout the course.

Introduction

The German National Computer Research Centre provided the collaboration system used in this study as a public service. The system is called "Basic Support for Collaborative Work" (BSCW). Version 2 of the BSCW Shared Workspace System has won first prize in the European Software Innovation Prize 1996. The BSCW system enables collaboration by providing shared workspaces over the Internet. The BSCW supports document uploading, event notification, group management and much more. To access a workspace only a standard Web browser is needed. A shared workspace allows storage and retrieval of documents and sharing information within a group, which is defined by the user. This functionality is integrated with an event mechanism, as an e-mail web report or icon based link, to provide each user with an awareness of the activities of others within the workspace. On-going innovations continue to make this system highly supportive of educational collaboration. The BSCW developments have been partially funded by the European Union through the Coop WWW project and the CESAR project of the EU's Telematics Applications Programme. Partners of these projects contribute to the development of the system. BSCW is maintained and developed by the BSCW project group at German National Research Center for Information Technology (GMD) and the Institute for Applied Information Technology (FIT). FIT is a research unit of GMD, Germany's national research center for information technology and has a staff of about 70 researchers.

Evaluation Questions

The BSCW is complex and many different types of questions could be explored. This study focused on these six:

1. How many students from the Internet class participated in the BSCW system?
2. Do some students use the system more frequently than others do in a one-month period?
3. What were the e-mail variations?
4. What were the basic problems students had related to the BSCW system?
5. Were students satisfied with the course?
6. By the end of the course, what were the variations of participation in the BSCW system?

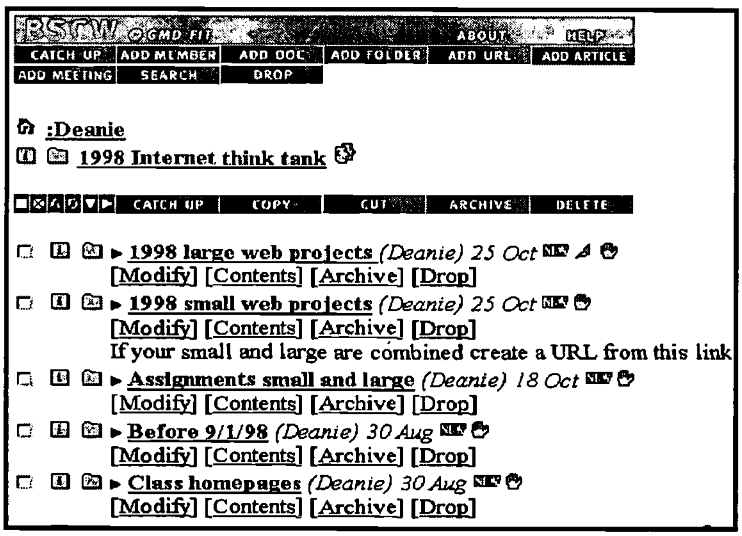
Data was analyzed according to five units of analysis: daily reports from the BSCW administrative system, individual e-mail messages, department student satisfaction ratings, a student survey and a focus group with the small San Antonio learning pod.

Description of the BSCW system

Figure 1. illustrates a collaborative workstation composed of folders that are the actual work areas of the system. There is a "Catch Up" button to find out what was missed since the last visit. The "Add Member" button allows you to invite others to your workspace. Documents of many different types can be added to the system. i.e. Word, Excel, Power Point, HTML and others. The "folder button" allows new workspace. "Add Article" allows exchange of information as a bulletin board system. The faces link to all the members of the workspace. While in the member's section, it is possible to send group e-mail to everyone or selected individuals in the group.

Each individual has a workstation identified by personal name at the top. Shared folders, containing information, become the collaborative "workstation" for the group. This group chose the name, "1998 Internet Think Tank". There are many sub folders within the group. The first folder contains articles as bulletin board threads, which were provided by the professor. Threads included: Confused...please help; Have an idea; Disappointments and Frustrations; Want an answer; and Did you really like something? These phrases triggered varied responses from the students. Archived information was provided in a separate folder for students to use as background information.

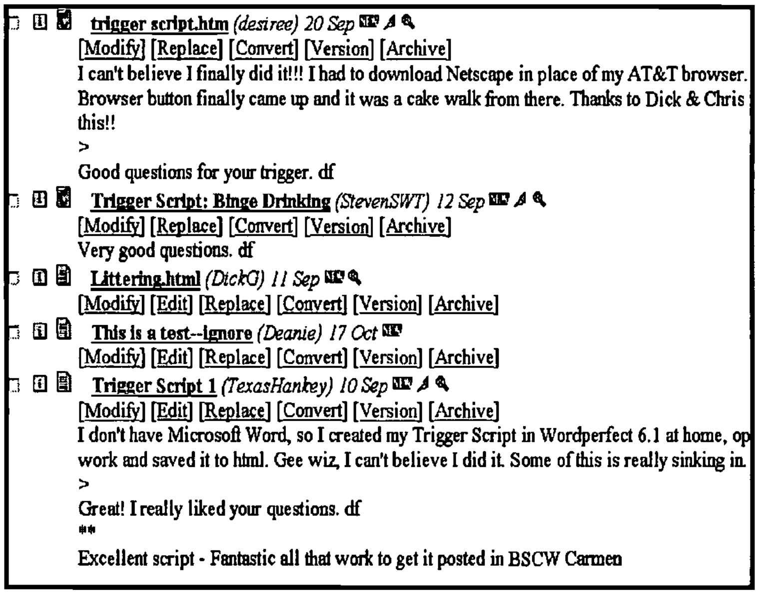
Figure 1. A Collaborative Workstation



Not all information has to be within the BSCW system, URL links can provide different types of information for access. The professor and students can add an unlimited number of links to related sites. The emphasis at the beginning of the course was to provide personal connections among students; therefore, students used a simplistic program for homepage development. Two basic sites, were used for developing these easy home pages: Free Yellow (http://freeyellow.com) and "The Express Page" (http://www.expage.com/). The media web site is the basic course manager for students. It includes fourteen different information sites including links to the course syllabus, course due dates, grading information, directions for getting on the BSCW, and tutorials. Any information stored in the BSCW is password protected and only members can access the information. However, the Web page with all related course information can be publicly accessed. (http://WWW.SWT.Edu/~df12/media/media.htm)

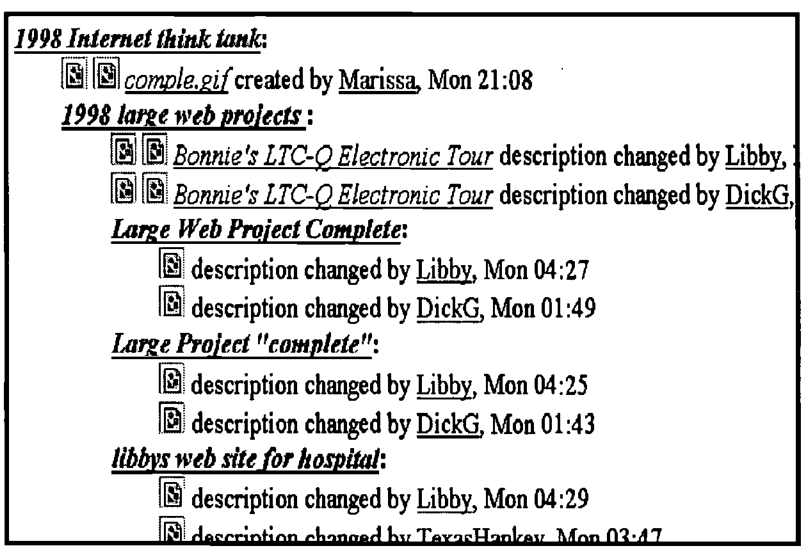
The students and the professor can all view the same documents at different times from their personal computer and see the remarks provided by different individuals. These comments provide feedback to the individual student, as well as, help other students with ideas and suggestions to improve their own work. The products are criterion referenced with acceptance or non-acceptance according to pre-stated criteria, so there is no grade competition for this portion of the course.

Figure 2. Peer and professor feedback



As soon as students create a new document and upload it to the BSCW, other students and the professor can simultaneously assess it for review. Individuals are sent an e-mail report for all the new events which have occurred during the last 24-hour period. Figure 3, depicts how the professor and students all know when and where new hyperlinked activity can be found.

Figure 3. Daily Report from the BSCW system



Reliability

Reliability standards were based on ProjectH methodology. Reliability assesses the degree to which variations in data represent real phenomena rather than variations in the measurement process. Two raters for the same data helped establish reproducibility of the results. Independence among coders was maintained. To ensure autonomy, coders were discouraged from discussing coding problems with each other. There was agreement of ratings between

the coders for BSCW activity. However, there was wide variability in the coding of e-mail categories; thus the experienced senior ProjectH researcher did the final coding of the e-mail. Difficulty in coding e-mail messages was due to the complexity and length of messages.

Group Process

This Internet section evolved as a request from six San Antonio students who wanted to take the traditional San Marcos classroom HHR 5332 Media course as an Internet based course. The group evolved from students who were enrolled in a traditional class with Dr. French in San Antonio, which was augmented with self-directed Internet based features. Two students who were not part of this original class became a part of the San Antonio group through word of mouth. Later other students from San Marcos and Austin heard about the course and asked to join. The guidelines for being in the first graduate Internet based media class included: 1.) Having had Dr. French as a professor in another class, which provided self, directed learning skills and mastering on-line modules concepts, 2.) Willingness to work collaboratively, 3.) Commitment to make the process work or 4.) Permission of the professor.

The San Antonio learning pod met as a group with the professor once before the class started in San Antonio. It appeared that the group would have sufficient skills within the pod to help each other meet class goals. As the semester progressed, one student, who was to act as a key leader dropped the course due to work and personal responsibilities. Two students worked primarily independently. One of these students who worked independently helped other students through telephone calls. Three students who I will refer to as the small pod (SP) became The remaining students who were not part of the SP group worked though the BSCW, e-mail, attended optional class lectures, and participated in optional open labs. This class expanded into a total of ten students.

Use of the BSCW System

During the first month of September, 80% of the students were participating. After the class was over, a focus evaluation session was held, and the SP group revealed that they had found a "backdoor" (using a URL to by-pass the sign-in section) to the BSCW system and tended to view the information as a group rather than log-on as three separate individuals. It is impossible to determine their activity in the BSCW. Their final projects were submitted as hard copy or on disk; thus, the SP group found a way to avoid the BSCW for about 75% of the course. Two of the SP group had major computer problems, which affected their early attempts and attitudes toward integration with the system.

Frequency of Use by Individual Student

Eighty percent of the students participated in different types of events such as reading, creating, deleting, renaming, replacing and changing descriptions. The range of "events read" was 18-59, with a mean of 25. Seventy percent of the students participated in the system by "creating events". The range was 2-15 with a mean of 6. Four percent "deleted items" from the system. The range was 2-10 with a mean of 6. Ten percent "renamed documents" with a range of 1-2. Thirty percent "replaced documents" with a range of 2-4 and a mean of 3. Forty percent "changed descriptions" of the documents by entering comments, which related to a document in the system as a form of peer review and support. The range was 1-9 with a mean of 5. Twenty percent of the students were recorded as not contributing or participating in the BSCW.

Analysis of e-mails sent to the professor in September .

All but one student sent e-mail to the professor the first month. A total of sixty-three messages were received. The number of messages received from individuals ranged from 1 to 20. Eighteen messages indicated confusion or frustration. Most of the messages were a mixture of questions and sharing of information. Two students had the professor in a different course at the same time and tended to share information in person. One student had a complex problem related to the BSCW and posted a question to the BSCW listserv. A range of professionals responded in two days and the problem was solved with this outside assistance. One response was from Rice University while the others were mostly from Germany.

Peer student survey

One student became frustrated with small problems related to the BSCW and conducted an on-line survey of the Internet students. He identified several problems and solutions, three of which are as follows:

1. The Netscape Navigator is the only browser that worked consistently within the BSCW workspaces. Other brands of browsers such as Microsoft's Explorer did not function well within the BSCW spaces, and in many cases would not allow access to all of the system's capabilities. Problems were also encountered with older versions of Netscape; therefore he recommend downloading the most current version from the Netscape home pages. The student's finding could be confounded by use of an older version of Explorer. There is no difference in performance between latest level versions of each browser.

2. Microsoft Office 97 or Microsoft Word and Microsoft PowerPoint are recommended to insure compatibility .

3. Some of the students did not have adequate hardware (CPU, storage, RAM) to access the BSCW and upload documents. He recommended discouraging students from signing up for Internet courses unless they have adequate equipment or frequent access to equipment resources. Current minimum equipment recommendations are: a Pentium 100 MHZ CPU , 32 megabytes RAM, and a 33.3 baud modem.

4. Students were confused about exact Internet specifications. For maximum effectiveness it is recommended that each student have access to the Internet through his or her own Internet Service Provider or SWT's Internet services.

Course Satisfaction

The Department of Health Service and Research anonymous student rating system was utilized. This tool consists of a three section 24 sentence instrument with agreement levels of 1-5. Each section is broken into an "overall" agreement statement. Course satisfaction was high as indicated by the following ratings:

1. Quality of Instruction (1.5),
2. Instructor method of measuring progress (2.5), and
3. Interaction with students (1.3).

Focus Group

The concept of collaborating over the Internet is new to most students and requires guidance and nurturing of students' attempts to interact with the system. By the end of the course, five students regularly wrote supportive statements to each other and interacted freely with each other. Two of the students contributed to the system but did not interact directly on the system other than as required. They did not write supportive statements to each other nor participate in the discussion groups. The three students in the small learning pod in San Antonio became a very close team and were highly successful in completing projects. However, they tended to avoid the BSCW for a variety of reasons. The group was lead by a student who was a lawyer and liked to solve her own problems even if this meant "driving to Canada for what is available in Mexico." One of these students told me that they knew that they would eventually get to right spot. This group was very reluctant to use other peers or the professor for support. They felt they had "used up" their amount of the professor time in the first part of the course. All three students held professional positions outside the course and liked to finish student projects into the early morning hours.

The process described by the SP group is supported by previous research findings. French (1995) has found that students can change their manner of learning. Qualitative and quantitative data for these behaviors have been collected over several years. In the fall of 1991, a t-test was employed to test paired differences on pre- and post-test scores for a group of 17 upper level undergraduates enrolled in a training class. The instrument used a Likert-type scale to measure beliefs about self-directed learning versus traditional learning. Significant differences were found in pre and post beliefs about self-directed learning (alpha .001). These results indicate that while most students enter university classes with primarily linearly based backgrounds, they can master new behaviors to facilitate restructured learning. On-going qualitative analysis with graduate focus groups has revealed that difficulties related to mastering new patterns of learning revolves around four key barriers:

1. Asking peers for help. Former educational programming implies that asking for help may be a form of "cheating." The SP group wasted many hours by not seeking more support.

2. Changing learning style. After a course is completed, most of my students have indicated they enjoyed self-directed learning and looked forward to other courses which used this style of teaching. However, other students have felt that teachers are "paid to teach" and thus, the teacher should be in front of class "teaching" the students. While the SP group liked the self-directed learning process because it allowed the three of them not to have to drive to San Marcos, they could have expedited their learning by not repeating the same mistakes.

3. Developing failing resilience. Some students become very frustrated with enduring temporary lack of success in mastering new skills, particularly high technology skills. Just the opposite seemed true for the SP group. One member of the SP group said that she had learned when to "quit;" while the others kept going and going. It is very rare for students to endure repeated failure. Having a lawyer in the group may or may not have affected this group's process.

4. Personal reward for success rather than the teacher's reward of the student. Many students have difficulty identifying and accepting intrinsic recognition apart from external rewards from the faculty or other outside influences. Basically, it appears that many students use the standard of "what is on the test" to determine what is most important to learn. The opposite was true for the SP group as they were rewarded by the joy of learning.

Conclusion

Both teachers and learners have to adapt to new styles of teaching and learning to meet future learning needs. Dr. Steve Bett (1994) has noted that colleges need to help students cope with the new learning environments and emerging conditions in a productive manner. He stresses that there needs to be more emphasis on process, how to learn, retool, update, communicate, and less on content. Bett noted that teaching can be content rich but the emphasis should be on process. He further points out that "it is no longer cost effective to focus just on the 'facts' which are true today but may take on new meanings tomorrow." (p.1)

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Online Survey Research: A Venue for Reflective Conversation and Professional Development

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Abstract: Educational research has long been conducted at a distance; both mail and telephone have successfully been used in survey research. The development of the Internet offers yet another medium over which research can be conducted. This study discusses the use of electronic mail as a vehicle for conducting educational research. It focuses particularly on the way in which electronic mail can be used to engage in reflective dialogues, which yield deep, qualitative data. The research methodology is presented along with examples of the dialogue that emerged from the semi-structured interview protocol that was used.

Introduction

Educational research has traditionally been conducted by undertaking studies of educational statistics, surveying those involved in educational practice, or more recently, conducting ethnographic studies of the practice occurring at one or a variety of sites. Many studies are conducted at a distance; written surveys, for example, are mailed to a number of people or institutions within a defined region; others are interviewed by phone to obtain more complete information than can be obtained in a written survey. Surveys though are limited by the questions asked, and often don't offer the researcher or the respondent the opportunity to review the response in order to restructure the question or refine the answer.

The development of the Internet offers another medium through which to conduct educational research. The very factors that make Electronic Mail (E-mail) a favored mode of communications, the fact that E-mail is asynchronous and text-based, lends itself to exchanges that are timely and thoughtful. In this paper we describe a project in which E-mail was used as a medium of educational research, and the quality of data that emerged from that process. The project is described, with an emphasis on the methodology, and examples of the data are presented. The viability of text-based E-mail as a research tool, the process of finding participants, and gathering sufficiently detailed information from the participants is also discussed.

Survey Research

The use of online survey research is relatively new. Hiltz and Turoff (1978) discussed the possible use of computer-mediated communication as an opinion research tool, especially using predictive data gathering techniques such as Delphi. Honey and McMillan (1994) used online technology to interview subjects who had participated in an earlier national telecommunications survey (Honey & Henriquez , 1993). All but two participants completed open-ended questionnaires using the Internet. James, Wotring and Forrest (1993) found that online surveys are "fast, relatively inexpensive and allow users to request feedback that can clarify misunderstandings about the instrument" (p. 52). Thach (1995) analyzed the use of E-mail to conduct survey research and found it to be cheaper, easier to edit, faster to administer, simpler to invite participants, a higher response rate, more candid answers, and a potentially quicker response time with a wider area of coverage. The speed of electronic transmission allows messages to be transmitted worldwide in a matter of minutes as opposed to traditional mail which may take months to

reach a country outside the U.S. This allows for quick data collection from a variety of populations, which might otherwise not be utilized.

E-mail is particularly well suited as a vehicle for conducting personal interviews when space and time do not connect the researcher and subject. Personal interviews are the most effective way of obtaining the cooperation of the interviewee, and allow for the most flexibility in asking questions, probing for answers, and building rapport (Katz, 1993). E-mail interviews can be viewed as a dialogue between individuals that can easily and inexpensively be transformed into usable data, making them a highly valuable tool for conducting research (Thach, 1995). Online technology overcomes the barriers imposed by space, time, and location (Harasim, 1993). Foster (1994) listed various advantages of the online interview format, including: it is relatively inexpensive; interviews can be sent many places at the same time; it is asynchronous, meaning respondents can answer when it is convenient; respondents can choose to participate or not; the responses return in a form which is already readable for analysis; the data is easily transferred from a mail program to a program for analysis; and very little transcription is necessary. He did caution, though, that online interview protocols must be more self-explanatory and explicit than those conducted in face to face or telephone interviews. Foster also discussed the problems of using listserv sites as locations for posting an interview protocol, while Sudamlis (1992) stated that participants in online research are often self-selecting individuals who subscribe to listservs.

E-Mail and Reflective Conversation

E-mail has been discussed as a useful tool for teaching and learning. Used as a tool for online communication, E-mail has been credited with helping teachers move to more constructivist teaching practices than previously held (Heflich, 1998). An important aspect of this movement is the extent to which E-mail can stimulate discourse that leads to reflection by the participants. E-mail discussion groups have been used in preservice teacher education to help develop reflective thought (McIntyre & Tlusty, 1995) and the moral development of preservice teachers (Harrington, 1992).

Central to all of these efforts is the significance of the protected conversational space that is offered by E-mail. Online conversation has previously been characterized as reflective (Heflich, 1997). Reflective conversation is an exchange of ideas in which the expression and receipt of ideas leads to the construction of new understanding of their own experience among the participants. Bamberger (1991) has described such an exchange as "conceptual chaining" in which ideas are articulated, exchanged, recreated and re-exchanged as they move from person to person in a conversation. The reflective aspect of such a chain is the way in which individuals capture the ideas that are seemingly forming in the air and construct their own meaning from them as the reflectively integrate them with previously held knowledge.

Feldman (1995) has described the use of conversation as a research tool in the teaching of action research courses. Conversation for Feldman (1995) counts as a reflective, meaning-making process because it represents an exchange of ideas that lead to understanding. Conversations can become a tool for critical inquiry when the goal of the conversational exchange is to share and develop knowledge and promote understanding among the participants.

Conversation offers us an opportunity to reflect-on-action, as it allows us to discuss and process into our intuitive knowledge base (Iran-Nejad, 1994) things that have previously occurred. It can also involve reflection-in-action as we dynamically engage in conceptual chaining (Bamberger, 1991) in the midst of an ongoing dialogue. In either case, conversation serves as a vehicle for stimulating reflective thought and may lead to both personal and professional growth.

Reflective thought has long been considered an important aspect of professional growth. Argyris and Schon (1974) identified the contradiction between one's espoused theory, one's expressed beliefs, and one's theory-in-use, beliefs made evident by one's activity. Growth for Argyris and Schon (1974) was recognized as the dissonance between one's espoused theory and theory-in-use and taking steps to align them. Osterman and Kottkamp (1993) discuss the role of inquiry as an element of professional growth. It is inquiry among individuals that helps expose the contradictions between beliefs and practices of teachers. Feldman et al. (1996) argue that teachers in a reflective stance examine their own practice exposing and questioning tacit assumptions about their teaching. This allows them to reflectively evaluate past practices and seek alternatives.

Project Description

The project for which email studies were used was designed to evaluate the attitudes of educators who participate in online discussion groups regarding the impact that online technology has had on their practice as educators, and on the learning of their students. The project was concerned with understanding whether online technology is another educational fad, or whether it contributes to changes in educational practice from didactic to constructivist methodologies. Also examined was the assessment of the impact of Computer-Mediated Communication (CMC) on constructivist teaching and learning using the trends identified by Collins (1991). The questions the research attempted to answer were:

1. Are teachers with more access online technology in their classrooms more likely to exhibit the practices of a constructivist teacher identified by Collins (1991) than those who are isolated users of computer technology in their classrooms?
2. Which structural or sociocultural elements of school support the use of online computer technology in a constructivist manner?

Subjects

One assumption of the study was that educators with experience using online computer technology will possess insights into the changes that exposure to online resources will have on classroom instruction and the relationship between student and teacher. It was believed that this population would have ideas concerning the role of technology in the long-term restructuring of teaching and learning. The goal was to reach the typical case of an online educator. A typical case may be located by first developing the criteria that define the case and then seeking those who possess the defining characteristics (Lecompte et al., 1995). The typical case in this study is an educator whose commitment to using online technology is made evident by his/her participation in online educational discussion groups. In order to locate the desired population, notices describing the study were posted on a variety of listserv discussion groups geared toward educators. Thirty-five people responded to the posting. Of these 35, 24 respondents agreed to participate in the study. Efforts to reestablish contact with the original 24 respondents met with mixed success, so a second round of notices was posted. Twenty-five respondents ultimately expressed interest in participating in the study representing schools in 16 states and 6 countries. They represented schools that had already adopted the use of the Internet, and were experimenting with its use; and schools that were in the process of adopting the Internet. Fifteen of the educators came from that schools were primarily elementary; ten were from secondary or K-12 schools.

Materials

An interview protocol was developed for use in a written interview exchange, which allows for in-depth exploration of the contextual considerations involved in decisions to implement online technology, and integrate it into the curriculum. The use of a semi-structured interview protocol enables data collection to proceed in a conversational fashion. In an semi-structured interview the reflective element of the conversation leads to new thoughts on the part of the researcher and subject, leading to the construction of new meanings (Klave, 1990, cited in Miles & Huberman, 1995). Questions asked can follow the thematic outline, but be specifically addressed to the situation and concerns previously expressed by the subject.

Data Collection and Analysis

The interview protocol was used as a guide for questioning the respondents. Interview questions were sent by E-mail to each participant, one at a time. The respondent answered the question by E-mail before the next one was sent. This exchange of messages allowed the interview to adopt a conversational tone. Messages containing subsequent questions contained reference to the previous response. In this way the researcher and the respondents developed a rapport that allowed for a thoughtful, reflective exchange of

questions and answers. Once begun, the E-Mail exchanges lasted for a period of weeks. The researcher interpreted the data collected, then sent his interpretations back to the participants to be certain he understood their replies. Once agreement was reached, the responses were analyzed.

The data collected were qualitative, textual quotes as they appeared in the E-mail exchanges between the researcher and the participants. They were downloaded into Microsoft Word 6.0, where they were saved into separate text files of questions and answers for each participant. These files were then reformatted for compatibility with The Ethnographer 4.0, a qualitative data analysis program. Data analysis was conducted according to the guidelines of the Constant Comparative Method (CCM) (Glaser & Strauss, 1967). The goal of CCM is the emergence of theory from data, derived through repeated review of the data, each time examining it for common themes.

Results

The results of this study demonstrated several things, concerning both the objectives of the study and the methodology. This paper is mainly concerned with the results of the methodology. The results indicated that E-mail is a viable method for obtaining reflective data from participants. The participants in the study provided a large quantity of very thoughtful responses because it led them to think creatively about their practice. Reflective conversations have been recognized as stimulating professional growth among the participants (Feldman, 1995; Fine & Riggs, 1994; Lincoln, 1992). Conversation itself has been acknowledged as a mechanism for fostering reflective practice (Feldman, 1995; Osterman & Kottkemp, 1993; Schon, 1987); and online technology, used as CMC has been successfully used in organized professional development (Schrum, 1992), in reflective seminars at the university level (Harrington, 1992), and as an unanticipated consequence of online usage by professionals (Lincoln, 1992). This study appears to be the first example of an online research project fostering professional growth through interviews that resulted in reflective conversations.

Riel (1990, 1993, 1994) and Schrum (1992) discussed the positive impact of online communication on teaching and learning as an opportunity for professional growth. A number of study participants wrote about their interactions with others online. They valued online educational discussion groups and the relationships they develop with others who participate in them. Participants in this study cite online communications with others as one of the most valuable aspects of CMC. Some participants commented that the interview/discussions gave them the opportunity to explore ideas and reflect upon their practice as educators. The extent to which the interviews served as reflective conversations that led to professional growth, in the course of which the participants reorganized their own knowledge can be seen in the comments of one of the study participants to one of the interview questions.

Question: *What do you see as the future of education when you consider the impact of online technology? What sort of impact will it have on teaching and learning? What will be the role of a teacher? What will the life of a student involve? How will these represent a change from what exists today?*

Answer: *I am concerned about the isolation that computer use often entails. It does not seem to me, as I watch my classes work, that the use of online technology has fostered working together. I am concerned that much that has been developed in terms of authority systems over the past 100 years (selection media, reviewing for library materials, refereeing for academic journals, and the like) does not lend itself to a system of universal access and information such as the Internet. Obviously this has its good side, but I don't see much emphasis on teaching students to evaluate the information they get as I do teaching them to "access" it. I'm concerned, too, about the emphasis on the picture over the word. The web is more popular than gophers because of the ability to use pictures, etc., but I fit it much slower, actually, as an information source. But I read. My students look at the pictures and move on. It's almost impossible for me to imagine the future of education, technology changes so fast and we are obviously just at the beginning of online tool development and online information systems.*

Quite clearly this person had the opportunity to reflect on the question given the conversational space created by both the asynchronous nature of E-mail and the conversational methodology of sending one question at a time. The rapport developed between the researcher and the subject during the interview

process allowed the interview to become a rich source of data that fully explored the beliefs of educators. E-Mail which overcomes the limits of time and space seems to hold great promise for educational research.

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Preservice Teachers' Perceived Effectiveness of Technology Resources: A Cross-National Study

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Abstract: This study investigated cross-nationally preservice teachers' perceptions of the effectiveness of computers and technology in improving education. Among all participants, 180 students each from the United States and Taiwan were randomly selected. A survey instrument that identifies types and amounts of technology resources generally found in elementary, middle, and high schools was used. The results indicate that preserve teachers in both places valued a computer lab in each school and computers in each classroom higher than interactive video equipment or calculators. They also thought that these technology resources were more important and useful for students in high schools than in elementary or middle schools. Preserve teachers in the United States, however, had more positive perceptions of the effectiveness of technology resources in improving education than their counterparts from Taiwan. Findings of this study and their educational implications are discussed in the paper.

Cross-national or cross-cultural studies of computers in education have gained considerable attention during the past decade. This may attribute to the feasibility of this type of approach in (a) testing the generalizability of attitudes toward computers originated in one country to others, (b) broadening the perspective of researchers and thus helping to strengthen our sensibility for idiosyncratic features of our own educational system, (c) contributing to a better understanding of the relative influence of some significant variables on educational computing, and (d) looking for universal variables and relationship between variables that are cross-culturally valid (Wubbels, 1993).

There have been a number of research paradigms in cross-national inquiries of educational computing and technology. The questions pursued, however, tend to center on (a) assessing computer use in education at elementary and secondary schools (Pelgrum & Plomp, 1993), (b) comparing college students' computer attitudes with respect to gender difference, confidence, and anxiety (Leutner & Weinsier, 1994; Marakis, 1992; Marcoulides & Wang, 1990; Sensales & Greenfield, 1995), and (c) examining preservice teachers' attitudes toward computers (Liao, 1995; Paprzycki, Vidakovic, & Ubermanowicz, 1995). Very little research, however, has specifically investigated and compared cross-nationally preservice teachers' perceptions of the effectiveness of computers and technology in improving education.

It is very important to examine preservice teachers' perceptions since research studies have found that teacher perceptions of computer and technology are closely related to their computer use (Brownell, Brownell, & Zirkler, 1993; Huang, 1994; Huang, Waxman, & Padron, 1995; Huang & Padron, 1997; Liao, 1993) and that teachers who were aware of ways computer could help do their job better (Sheingold & Hadley, 1990). Investigation of prospective teachers' perceptions of computers in education in the United States and in Taiwan may help to reveal how much these teachers knew about computer and technology resources as well as to accomplish some of the objectives Wubbels (1993) stated. Therefore, the purpose of this study is to compare perceptions of the effectiveness of computer and technology resources in improving education between preservice teachers in the United States and Taiwan.

Methods

Subjects

The participants in the study were undergraduate education students from a southern state of the United States and northern Taiwan. Among all participants, 180 students from each place were randomly selected for study. Among the 360 sample subjects, 21% were male and 79% were female. Over 72% of them were between the ages of 18 and 25, 21% were between 26 and 35, and 7% were older than 35. Nearly 6% of them had never used a computer, and over 41% had used computer(s) for more than two years. However, the two groups of prospective teachers varied greatly in the compositions of their demographic variables. There were more males than females among preservice teachers from Taiwan than from the United States, whereas preservice teachers from the United States were older in age and had longer experience working with computers than their counterparts from Taiwan.

A computer course has been mandated as a teaching certification requirement in the southern state of the United States, and a "computer literacy" course was offered at the undergraduate level. In Taiwan, most colleges have offered introductory computer courses as prerequisites. The content of these courses contains the basic concept, operation of computers as well as software.

Instrument

The instrument used in this study is the Educational Technology Survey (Waxman, Huang, & Padron, 1992). This survey identifies types and amounts of technology resources that were generally found in elementary, middle, and high schools. It measures the extent to which the subject thinks that computer and technology resources will change schools and improve education of all students. All the 15 items are on a 5-point Likert-type rating, including "Very Effective," "Effective," "No Effect," "Ineffective," and "Very Ineffective" for improving students' education. In addition, there is a category for subjects to indicate that they are "Not Familiar" with the technology. A brief section on these prospective teachers' background was also included in the instrument.

The survey instrument was translated into Chinese for the use of sample subjects in Taiwan. Verification of the content validity of the Chinese version was done by reversing translation of it into English by English teachers who had not seen the English version. The result shows that there is no need for revision. The survey instrument has been found to be reliable and valid in prior studies (Padron, 1993). For the present study, the alpha reliability coefficient is .81 for the subjects in the U. S., and .90 for the subjects in Taiwan. This suggests that the instrument is reliable in measuring perceptions of these prospective teachers from both places.

Procedures and Analysis

The survey instrument was administered at the beginning of the academic year to the preservice teachers by experienced researchers in both nations. Preservice teachers responded anonymously. Frequency distributions displayed the percentage of preservice teachers' ratings on each resource item. A series of chi-square test was conducted to determine whether there were significant differences between preservice teachers from the United States and Taiwan in their perceived effectiveness of technology resources in improving education.

Results

The frequency distributions show that, in general, preservice teachers from both places thought that technology resources were effective rather than ineffective in improving education for all students. Over 60% of preservice teachers in the United States perceived that (a) a computer lab in each elementary, middle and high school, and (b) several computers for each elementary, middle and high school classroom would be "Very Effective" in enhancing education. Over 60% of preservice teachers in Taiwan thought that these two types of

computer resources were either "Effective" or "Very Effective." Less than 10% of preservice teachers from both places responded "Ineffective" or "Very Ineffective" for any type of technology resources, except the responses from preservice teachers in the U. S. on the *Calculators in elementary or middle schools* item.

Table 1 reports the chi-square results. The results from chi-square analyses reveal that there were significant differences between the two groups of preservice teachers in their perceived effectiveness of all types of technology resources in improving education. More preservice teachers in the United States than in Taiwan viewed that (a) a computer lab in each elementary, middle, and high school ($p < .001$), (b) several computers (4 to 5) for each elementary, middle, and high school classroom ($p < .001$), and (c) one computer for each elementary, middle, and high school classroom ($p < .01$) were "Very Effective," whereas more preservice teachers from Taiwan viewed these computer resources at all schools "Effective" rather than "Very Effective."

The Chi-square results also reveal that the two groups differed significantly in their perceived effectiveness of other technology resources. Again, more preservice teachers in the United States than in Taiwan indicated that calculators in elementary, middle, and high schools were "Very Effective" in bringing change and improving education, whereas more preservice teachers in Taiwan than in the U. S. indicated that calculators in elementary, middle, and high schools were "Effective." The chi-square values for the effectiveness of calculators are significant at $p < .001$ for all schools. Furthermore, preservice teachers from both places thought calculators as being "Very Effective" for high school rather than for elementary and middle schools.

Table 1

Preservice Teachers' Perceived Effectiveness of Technology Resources

Resource	VE	E	NE	I	VI	NF	Chi-sq.
A computer lab in each elementary school							88.10**
U. S.	64.7	33.0	1.1	0.6	0.0	0.6	
Taiwan	17.8	62.2	13.3	2.2	0.0	4.4	
A computer lab in each middle school							78.80**
U. S.	71.8	27.8	0.0	0.6	0.0	0.0	
Taiwan	26.7	61.1	6.7	0.6	0.6	4.4	
A computer lab in each high school							73.51**
U. S.	79.8	19.7	0.0	0.0	0.6	0.0	
Taiwan	35.6	55.6	3.3	0.6	1.7	3.3	
One computer for each elementary school classroom							26.44*
U. S.	40.0	42.2	6.9	4.0	5.8	1.2	
Taiwan	23.9	45.0	16.7	5.6	1.7	7.2	
One computer for each middle school classroom							25.27*
U. S.	42.8	39.7	7.5	4.6	5.8	0.6	
Taiwan	26.7	50.0	10.0	5.0	1.1	7.2	
One computer for each high school classroom							27.45*

U. S.	45.4	34.3	8.1	5.2	6.4	0.6	
Taiwan	32.8	48.9	7.2	3.3	0.6	7.2	

Resource	VE	E	NE	I	VI	NF	Chi-sq.
Several computers (4 to 5) for each elementary classroom							71.07**
U. S.	68.8	22.5	2.9	1.2	2.9	1.7	
Taiwan	27.8	34.4	14.4	8.9	3.3	11.1	
Several computers (4 to 5) for each middle school classroom							56.01**
U. S.	73.4	19.7	1.7	2.3	1.7	1.2	
Taiwan	35.6	36.7	8.3	7.2	2.8	9.4	
Several computers (4 to 5) for each high school classroom							40.45**
U. S.	74.6	19.1	1.2	2.3	1.7	1.2	
Taiwan	43.3	34.4	6.7	5.0	2.2	8.3	
Calculators in elementary school							
U. S.	14.0	33.1	6.4	24.4	19.2	2.9	60.45**
Taiwan	7.2	53.3	19.4	12.8	1.1	6.1	
Calculators in middle school							45.55**
U. S.	22.8	45.6	4.7	15.8	8.8	2.3	
Taiwan	11.1	71.7	8.9	5.0	0.0	3.3	
Calculators in high school							41.37**
U. S.	48.8	38.8	1.8	5.3	4.7	0.6	
Taiwan	29.4	62.8	5.0	0.0	0.0	2.8	
Interactive video equipment in each elementary school							38.51**
U. S.	0.0	45.4	35.5	9.3	0.6	9.3	
Taiwan	0.6	16.7	55.0	15.0	3.9	8.9	
Interactive video equipment in each middle school							38.57**
U. S.	0.0	51.7	33.1	5.2	0.6	9.3	
Taiwan	0.6	21.1	57.2	10.0	1.7	9.4	
Interactive video equipment in each high school							32.63**
U. S.	56.4	25.0	7.0	1.7	0.6	9.3	
Taiwan	31.1	52.2	6.7	1.1	0.0	8.9	

Note. VE = Very Effective, E = Effective, NE = No Effect, I = Ineffective, VI = Very Ineffective, NF = Not Familiar
* $p < .01$. ** $p < .001$

Preservice teachers in both places generally perceived greater effectiveness of interactive video equipment in high schools than in elementary and middle schools. More preservice teachers in the United States than their counterparts from Taiwan thought that interactive video equipment in each high school was "Very Effective" and in each elementary and middle school was "Effective" ($p < .001$). Furthermore, over 50% of preservice teachers in Taiwan thought that interactive video equipment was "Effective" only in high schools, but had "No Effect" on educational improvement in elementary and middle schools.

Discussion

Findings of this study reveal that there were certain common characteristics among preserve teachers in the United States and Taiwan. In general, preserve teachers in both places valued computer and technology resources highly. However, they valued a computer lab in each school and computers in each classroom higher than interactive video equipment and calculators. Furthermore, they all agreed that these technology resources were more important and useful for students in high schools than in elementary or middle schools.

Nonetheless, there were significant differences between the two groups of preservice teachers. Preserve teachers in the United States had more positive perceptions of the effectiveness of technology resources in bringing change and improving education than their counterparts from Taiwan. More of them responded "Very Effective" on most of the computer and technology resources. On the other hand, more preservice teachers in Taiwan responded that they were not familiar with computer and technology. Preservice teachers in Taiwan were also more conservative in their belief of the effectiveness of computer and technology in enhancing teaching and learning processes. An examination of their computer background reveals that preservice teachers in Taiwan generally have less experience in working with computers and other types of technology resources than their counterparts in the United States. This may partially explain the disparities found in this study, since prior experience in computer has been reported as the major factor in determining prospective teachers' perception of computers (Brownell, Brownell, & Zirkler, 1993; Huang & Padron, 1997). Increasing computer experience corresponded to more positive attitudes toward computers (Liao, 1995). Another plausible explanation for the significant disparities may include difference in social and cultural concepts. Preservice teachers in Taiwan may rely more on intrinsic efforts like individual's hard working and educational aspiration rather than external resources for educational improvement. Future research needs to investigate various factors related to differences in perceptions of computer and technology among preservice teachers of different places and cultures.

Findings of this study have several educational implications. First, it contributes to the knowledge base of the common belief of preservice teachers between countries and how they differ from each other in terms of their perceived effectiveness of technology. Second, the study identifies the technology areas that preservice teachers are less familiar, i.e., interactive video, and calls for teacher education program to address such needs. Third, it invites further investigation of the impact of some variables such as social value and cultural heritage on preservice teachers' perceptions of computer and technology in educational improvement. Teacher educators, however, should keep in mind that to make computers and other technological resources effective for educational improvement, preservice teachers must have competency in utilizing these resources. Indeed, the added value which telemedia may bring to education processes is strictly linked to how it is used (Trentin, 1996). Teacher educator may get help from research studies that provided strategies and suggestions to enhance preservice teachers' use and appreciation of computers and other technological resources (Handler, 1992, 1993; Petrakis, 1992; Stephen & Ryan, 1992; Tearle & Davis, 1995).

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Teachers and Technological Tools in the Middle School

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Abstract: This paper provides an overview of a pilot study conducted in Northeast Ohio. The study considered the questions; 1) Are the technologies available in schools supportive of the classroom goals of teachers and students? and 2) What reasons influence the use of technologies in their learning activities? The present study attempts to examine what learning activities are applied across a variety of subject areas, how technology assists students' learning activities, and why technology is/isn't used in the typical learning activities. The study documented the typical learning activities and potential role for technology within the classroom learning environment of the effective middle school teacher. Learning activities such as data collection, data analysis, visual/written communications, and design were employed as core categories for analysis of technology use, non-use, and potential.

After two decades of personal computing in the schools it is easy to overlook the fact that many teachers' experiences with technology fall short of the successful and exciting experiences reported by researchers (Ambron and Hooper,1990). What is reported; the individual instances of success, innovative technologies, and well funded development projects provide a stimulating look at what can occur when circumstances are optimal. Unfortunately teachers work in less than optimal conditions. The occupational world of most teachers is quite different from that of an educational technology researcher. Classroom teachers do not design the software, hardware or technologies they use. They have minimal control over instructional time, preparation time, or the teaching content mandated by their district. In regard to technology support, the classroom teacher has comparatively little daily assistance with technology.

For the average teacher the use of technology has not been an empowering experience. Consequently, the level of technology use has remained relatively low. There is concern that the quantity of technology needs to increase (Morrison, Lowther, and DeMeulle, 1999). Criteria identified in recent technology surveys suggest that emphasis is placed on the quantity of technology available in schools rather than the purpose of the intended technology use. From the standpoint of the students, the end users of the technology, or the teachers, the facilitators of learning, the process is the reverse of what is expected. The critical variable of interest is student learning. Technology offers one tool for accomplishing this learning. Using level as the primary variable ignores the goals of the teachers and the needs of the students. Quantity alone disregards the context of the learning activity and discounts whether technology supports classroom instruction.

Agreement with the position that the quantity of technology in schools needs to increase is dependent in part on assumptions regarding the design of the technologies provided teachers. A key assumption is that the technology identified in surveys was designed for use by teachers and students. This is not the case for much of the technology hardware available in schools.

Two questions merit considerations; 1. Are the technologies available in schools supportive of the classroom goals of teachers and students? and 2. What reasons influence the use of technologies in their learning activities? These are complex questions but they can be considered in light of studies of how people work in technology intensive workplaces. Holtzblatt and Jones, (1993) have pointed out that well designed technologies that take into account the reality of what people do on the job can boost productivity, enhance job satisfaction, and give workers a clear sense of what needs to be accomplished in their workplace. The essential point is that technological tools that are insensitive to the work being performed lead to the negative consequence of reduced productivity. The argument for teacher and student use of technology hinges in part on how well available technology represents and supports what teachers and students do. A sizable amount of software has been developed for the classroom including tutorials, drill and practice software, and educational games. These applications are designed to deliver instruction by complementing or replacing the teacher. Underrepresented in the software designed for school use category are tools for increasing productivity. Much of the tool/productivity software such as the word processors databases, spreadsheets, and graphics were designed for an industrial or business audience. Both the context and the content of classroom teaching are markedly different from that of industry.

Those of us in teacher preparation who work in the field of educational technology recognize technology as an outstanding resource. It provides opportunities for learning, tools for productivity, and a medium for creativity. However, many teachers still perceive technology to be confusing, complex and cumbersome. Despite the proliferation of graphic user interfaces, teachers report that productivity software is not intuitive and that the software fails to address the needs of their classroom situation. Productivity software is essentially re-purposed for classroom use. Consequently, teachers are hesitant to implement the technology with their students since the audiences are dissimilar. As an example, elementary teachers participating in an inservice technology workshop indicated a preference for using *The Writing Center*, a writing and publishing tool designed for classroom use over Microsoft Word despite the expanded feature set offered in Word and pressure by their administrators to use the more powerful software (P. Comstock, personal communication, June 16, 1998).

Review of Literature

Morton (1996) points out that "while the real world uses computers to move forward, schools often use them in a misguided efforts to support 19th-century instructional practices." In the beginning period of computer education teacher s learned BASIC as an introduction to technology use in classrooms. They couldn't use their training in their classroom. After that period, teacher education programs for technology use in schools focused on general terms such as computer literacy that emphasizes productivity tools like word processing, database, spreadsheet, and communications in a broad spectrum of activities. However, the general computer literacy skills ignored the integration of technology into regular activities in various subject matters. Guidelines for teachers were needed on how to integrate computers in various subjects (Yaghi, 1996).

In 1997 National School Technology and Readiness (STaR) Assessment conducted a survey on technology presence, use, and integration in typical American schools. STaR Assessment was based on data collected from nearly 80,000 public schools as well as supplementary data. According to the STaR report, only less than 3% of classrooms have fully integrated technology into the curriculum while 59% American schools have no technology or inadequate technology in their schools. 12% of schools are using technology yet still not devoting adequate time and resources to quality content, and the remaining 26% are still considering technology an "extra" (National STaR Assessment, 1997).

The Tennessee State Department of Education examined the teachers' perceptions about the use of technology. According to the findings, technology was viewed as a beneficial tool for classroom teaching. But the negative comments were on issues of inappropriate use, lack of teacher training and support, piecemeal and unintegrated use, too few computers for too many students, lack of an integrated infrastructure, and lack of a systems approach (Lewis, 1996).

Niederhauser (1994) examined how teachers' best beliefs about the effectiveness of using computers in instruction, the amount, frequency, and type of CAI teachers engaged in, frequency of use, subject area for software used, and the types of technology training they had received. The finding was that some teachers considered technologies as tools that students use in collecting, analyzing, and presenting information, while others viewed them as transmission tools that can be used to present information, give immediate reinforcement, and track student progress.

From a study by the Office of Educational Research and Improvement (OERI) in Education Reform Program, the researchers found that only a minority of classrooms where the school environment already provided adequate levels of technology access, technical assistance and supported time for learning about technology integrate technology for learning activities. To integrate technology in the classroom they suggested: 1) help in planning for technology uses and acquisitions, 2) training in how to use new hardware and software, 3) demonstrations and advice on how to incorporate technology into instruction, 4) On-demand help when software problems or hardware failures arise, and 5) low-level system maintenance. The researchers have argued that the critical transformation for classrooms is the shift from teaching discrete skills and information within specific subject areas to centering instruction around authentic, challenging tasks (Means and Olson, 1995).

On the other hand, the emphasis on technology in American schools has focused on quantity of technology rather than the use of technology in the classrooms (Jurema, 1996). Some argue that simply having more technology does not persuade teachers to use it into their classroom teaching and that teachers adopt a technology when that technology helps them do better what they are currently doing (Marcinkiewicz, 1994: Cuban, 1989).

Purpose of Study

The goal of this preliminary study was to establish a baseline on what technologies are most useful for students, what technologies fit appropriately and effortlessly into classroom learning. The study considered the questions; 1) Are the technologies available in schools supportive of the classroom goals of teachers and students? and 2) What reasons influence the use of technologies in their learning activities? This preliminary study examined technology use from an activity-oriented view. This viewpoint guided our research focus: 1) What are the typical activities that students do in the classroom. 2) How can technology assist students' learning activities? 3) Why is/isn't technology used in the typical learning activities? The long-term goal of the study is to suggest an idea for teacher preparation programs that can assist in the design and integration of technology.

Methods

Within the field of software design there exists an organizing structure for initiating an analysis of user needs (Kuhn, 1996). The structure is a design approach that employs an activity-oriented view assessed from the perspective of the user audience. This pilot study initiated an examination of technology use from an activity-oriented view. Middle school teachers and students were targeted as the user audience. Central to the goal of identifying learning activities was to understand the middle school teachers and the tasks they wish to achieve with their students. A secondary goal was to identify existing technology based tools that might serve the teachers and students with these learning activities. The process of determining typical learning activities and enhancing some of those activities with technology began by surveying teachers.

The phenomena of learning in a middle school setting occur across a wide range of conditions. Agreed upon descriptions of classroom activities are elusive. A survey was developed to obtain a baseline of learning activities that span the curriculum. The survey was distributed to ten middle school principals representing urban and suburban school districts in Northeast Ohio. The principals were instructed to select two teachers to participate in the survey. The criteria were provided to the principals for teacher

selection. The teacher was to have at least three years of teaching experience, the students of this teacher should consistently perform at or above expectation, and the teacher should also have a history that included parental requests to have students placed in his or her class. Expertise in technology was absent from the selection criteria. The selected teacher completed an anonymous survey composed of three sections and returned it to their principal.

The first section consisted of six questions that contributed background information on the respondent. Included in this section were questions on teaching experience, grade level, subjects taught, technology expertise, student expertise in technology, and the type of technology available to the teacher.

The second section provided a list of nineteen possible learning activities along with a five-point scale indicating the anticipated frequency of the learning activity. Traditional and technology based methods for implementing the activity were listed below the learning activity. The teachers were directed to rate all items that applied. The nineteen activities represented a range of learning activities including; writing, collecting data, organizing data, analyzing data, presenting information, discussions, reviewing instruction, and developing projects. Ideas for the learning activities were based on sample activities included in assignments submitted by teachers enrolled in an instructional development course during the past ten years.

The third section of the survey included eight questions pertaining to students use of computer based tools. These statements were also scored using the five-point scale. In addition, the teachers were asked to select the reason(s) for the score. Twenty-four reasons were provided. The teachers were encouraged to select all reasons that applied or to choose "Other" and explain this choice. The respondents were informed that this was a pilot survey and that comments were welcomed.

Results

Eighteen of the twenty surveys were returned for examination. Three surveys were not returned in time to be included in the results. Participants indicated minimal difficulty completing the survey. All of the surveys were coded to insure confidentiality.

Section One of the survey provided background information on the participants. The pool of respondents represented all levels of teaching experience from less than 4 years to over 20 years. The teachers taught in grades 5 through 8. The scope of subjects included Language Arts, Mathematics, Science, Social Studies, Foreign Language and Computers with many teachers responsible for more than one content area. The rating of teacher skill in the use of technology ranged from novice through expert with a mean score of 2.94. However, the mean score was not reflective of the population. A bimodal distribution emerged with 40% of the teachers rating themselves as somewhat experienced and 35% rating them as advanced. The average rating of students' skill with technology was 1.89, just below "Somewhat experienced."

The technology available to the teachers varied considerably. This was true within schools as well as between them. All respondents indicated the availability of minimally a computer in the classroom or access to a computer lab. In addition all but two respondents indicated the availability of a monitor and videotape player. Calculators were not listed as technology equipment in Section One. Some respondents added calculators to the "Other" category of this section. Based on responses provided in Section Two on learning activities, 15 of 18 respondent's classes had access to calculators. The three classes that did not use calculators were taught by Language Arts teachers.

Section Two of the survey was included to ascertain what learning activities are commonly implemented in the classroom and to discover what if any technologies the teachers employ with the learning activities. Seventeen of nineteen learning activities had an average score for one or more method of implementation near or above 4.0 signifying that the activity occurred at least occasionally in the classroom. Two activities; Writing Correspondence 3.06 And Drawing Maps 3.06 failed to rate at a meaningful level. In retrospect, both activities could have been incorporated into other learning activity categories.

As expected, traditional methods of implementation averaged higher than technology based methods. The singular near exception was the use of calculators for analyzing data. Respondents rated calculator use at 3.78 to a manual computation rating of 3.83.

Section Three focused on student use of computer based instructional tools such as word processors, databases, draw and paint programs, the Internet, Spreadsheets, E-Mail, Presentation software, and calculators. Two tools; word processors and calculators recorded average student use ratings of 3.28 and 3.72 respectively. The average score for the other tools was 1.98. Common problems cited for low use of the eight tools included; Not enough equipment, I lack training, Time consuming, and Not useful. Common reasons cited for use of the tools included; Students have skills to use, Useful, and Equipment is available.

Conclusion

This study provided a snapshot of the middle school teachers who participated in the survey. The teacher sample was diverse but the sample size was small. The bimodal distribution of technology skills reported by the teachers may not be indicative of the general middle school teacher population.

The teacher responses confirmed that the learning activities listed in the survey were representative of the learning activities that occur in middle school classrooms. As such, the activities offer a starting point for examining an activity-oriented view of middle school teachers and students as technology users. In particular, it advances a framework for further examination of the original questions.

Regarding question one: Are the technologies available in schools supportive of the classroom goals of teachers and students? Two tools, word processors and calculators were occasionally used in many of the learning activities such as writing or data analysis. In addition, the frequency of activities involving data collection, data analysis and project development imply that other existing tools such as graphics programs, spreadsheets, and Internet access may be recommended for classroom use.

Regarding question two: What reasons influence the use of technologies in their learning activities? Several variables proved revealing. Lack of equipment was identified as a key reason for student non-use of tools. Limits on available equipment influenced teacher's ability to incorporate computer tools in the learning activities. This issue was compounded by a belief reported in Section One of the survey that students lacked the skills to use the tools. Consequently, it is difficult to confirm whether the technologies currently available are well suited or if access to equipment is the problem. The argument that they may not be well suited is supported indirectly as 14 out of 20 respondents reported that they either had access to many computers in their class, a computer lab or both.

Other variables may be influencing student use of computer tools, only 5 teacher responses out of a possible 144 responses indicated that a specified computer tool was selected because it was "Easy to Use." One can hypothesize that even when technology was the method of implementation it was not perceived to be easy to implement. Fifteen percent of the responses indicated that the reason for student use of computer tools was that it was useful. Two opposing interpretations of this low result are: 1) the teachers do not perceive technology as useful in supporting a learning activity independent of their ability to use the tool or 2) lack of equipment and problems such as lack of skill by students and teachers, or difficulty with use discouraged the teachers from identifying the tools useful.

As a pilot, this study generated more questions than it answered. As expected the technology skills of the middle school teachers span a wide continuum. The survey Section Two responses suggest that the learning activities listed reflect some of the common learning activities that middle school teachers implement with their students and Section Three suggests that reasons for use and non use of technology are varied. In this preliminary phase of the study, emphasis was placed on reframing the question of why the level of technology use is low away from a traditional view to a more teacher-centered view of

technology. Clearly, a more extensive follow-up study is required to establish the factors that influence the use of technology and to determine if current tools are supportive of the classroom goals of teachers and students.

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The Status of Technology and Technology Integration in Teacher Preparation Programs: Needs and Reality

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Abstract: A survey was mailed to all deans of education across a five-state region in February 1998. The inquiry focused on the status of particular indicators of technology integration such as infrastructure financial support, staff development, use of technology, Colleges/Schools/Departments of Education.

Another survey was mailed to districts that had more than 50% of their enrollment classified as economically disadvantaged along with high student enrollment. Technology coordinators were asked to complete a questionnaire that focused on their technology training experiences and present needs.

In general colleges of education reported an increased level of support for technology but still felt the support for technology at their institutions was meager. This paper describes the differences in technical support, financial support, access to staff development and current use of technology at selected institutions, the expressed needs of current practitioners in the field, and how the two may better fit the needs of the field.

Introduction

Projections in the United States show that two million new teachers will be needed in the next ten years. It is also well documented that the current rate of technological change is phenomenal. Computing power keeps improving (following Moore's law of doubling processing power every 18 months), as well as rapid advances in telecommunications technologies and expansion of the Internet.

Traditionally, our schools have looked to institutions of higher education to provide leadership in new ways of doing things. Today, institutions of higher education hold great responsibility to provide leadership for the infusion of technology into our schools and to model appropriate use of the technology in their own teaching situations. How are institutions of higher education measuring up to the challenge?

Purpose of the Study

Recently, the National Council for Accreditation of Teacher Education (NCATE) called for increased focus on technology in teacher education programs, citing the need for technology to move from the periphery of teacher preparation to the center of teacher preparation. Recognizing that "some schools of education are in the vanguard of introducing technology into teacher preparation," Wise reports that "...most schools of education have not yet fully integrated technology into their teacher preparation programs (1997, p.v). With this call from NCATE for "vigorous action" to integrate technology into preservice teacher education programs, the purpose of this study was to examine teacher education programs at both public and private institutions of higher education in the South Central region to:

• Determine how and to what degree training instructional technology is being incorporated into those programs in order to establish baseline data for the region

• Determine status of technology support provided by the institution

The study also sought to identify current needs felt by technology practitioners to better inform changes in the current system.

Technology at Institutions of Higher Education

- A mailout survey entitled, *Technology and the Preservice Teacher Education Program: A Survey of Colleges, Schools, and Departments of Education* was distributed to all the deans of the Colleges of Education across a five state region (Kansas, Missouri, Nebraska, Oklahoma, Texas) in February 1998 requesting their participation in completing a questionnaire. Responses ranged from small private institutions of higher education to large state sponsored institutions of higher education and included both public and private institutions of higher education. The inquiry focused particular indicators of technology integration in their Colleges/Schools/Departments of Education. Survey questions were grouped around seven major topics:
- Group 1 Institutional information/general technology course information
- Group 2 Status of technology support
- Group 3 Technology skills of preservice teachers
- Group 4 Hardware technologies faculty members use in teaching methods courses
- Group 5 Hardware technologies preservice teachers required to use in courses
- Group 6 Software faculty members use in delivery of methods courses
- Group 7 Software preservice teachers required to use in methods courses

Conclusion

In general Colleges of Education reported an increased level of support for technology but still felt that support for technology at their institutions was meager. In addition, this increased level of support meant many things to different people. For example, one university saw the installation of computer labs for faculty use as support while another university already equipped with computer labs saw technical assistance and training given to faculty as increased support. Access to and use of the Internet by both faculty and students, along with administrative support and encouragement for the use of technology were rated as adequate.

Colleges of Education were asked about technology skills that might be important to teacher education majors and were asked to respond to their (the university) perception of the adequacy of general skills training currently received by preservice teachers. Institutions of higher education felt that preservice teacher skills were adequate in their ability to operate a computer system to use software and good use tools that were directly related to their own professional use such as productivity tools along with databases, word processing, and spreadsheets. Other skills were reported as being meager.

In response to the queries regarding university faculty members using certain hardware technologies and software technologies, the majority of responses indicated a low level of use by faculty. The exceptions to this were in the use of the VCR in instruction and the use of word processing, spreadsheets and presentation software where responses were in the middle to high range.

In response to information regarding preservice teachers being required to use certain hardware and software technologies, the majority of responses again were within the low category. The exceptions to this were the preservice teacher use of the computer and interactive video disc, along with the use of word processing, presentation software and web browsers where responses were in the middle to high range. A complete report and breakout of responses can be found on the South Central Regional Technology in Education Consortium-Texas website. http://www.coe.tamu.edu/~texas/

Current Technology Needs by Teachers and Coordinators in the Field

Another survey was mailed to 400 school districts in Texas that had more than 50% of their enrollment participating in a free or reduced lunch program combined with high student enrollment. Responses ranged from small rural to large urban districts, some having enrollments in excess of 200,000 students. The survey sought to identify technology-training needs of current teachers in the field and to then provide information to institutions of higher education to guide them in designing technology courses.

In general, nearly forty percent of the technology coordinators positioned themselves on the lower half of the training/experience scale, the majority of the respondents marked limited or fair training or experience in technology use. Sixty percent were positioned on the upper half of the scale. The majority of those respondents ranged from adequate to significant training or experience in technology use. Of those, only fifteen percent claimed to have advanced experience or an advanced degree in technology use. Of the one hundred and sixty-three respondents, only three indicated that they had earned a Masters Degree in Educational Technology.

In response to the number of preservice hours of technology training, the coordinators claimed one hundred and ninety hours. In response to the number of inservice hours of technology training, the coordinators claimed two hundred eighty-one hours.

The courses of most interest and need to the respondents were:

- Integrating the Internet into the Classroom
- Technology Integration into the Classroom Curriculum
- Multimedia Development
- K-12 Distance Learning
- Basic/Intermediate Web-Construction
- Technology Planning

A complete report and breakout of responses can be found on the South Central Regional Technology in Education Consortium-Texas website at http://www.coe.tamu.edu/~texas/.

Conclusion

In closing, there is an imbalance between the institutions of higher education and their ability to provide substantial preservice training in cutting edge technologies. This study found that there were many "islands of excellence," but for the most part, the needs of teachers in the field were for staff development and training in technical areas of educational technology that institutions of higher education were not yet able to provide. The institutions of higher education themselves were coping with issues related to training their staff, accessing equipment for their faculty and infusing technology more into their teaching situations. Higher Education is still internally focused on their needs and is not yet able to really focus on preservice teacher education program technology needs. But right now, what can institutions of higher education do to move their organizations to be more "user friendly" towards technology? Let us consider the following courses of action:

- Colleges of Education can make sure that the technology infrastructure and associated support services follow a performance support model. Support should be provided to those first requesting it. A reward structure should be made available for faculty willing to make positive changes.
- The technology infrastructure and technology infusion program should be given a top priority and considered "mission critical."
- Staffing patterns should be adjusted to support the work to be done.
- Fiscal, facility, and human resources should be reallocated to support mission critical.
- The technology should be distributed only as widely as it can be supported. This support must come in the form of on going staff development and training for staff at all levels and on going, just-in-time technical support.

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A Comparison of an All Web-Based Class to a Traditional Class

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Abstract: A study at California State University at Northridge, (Schutte, 1997) and (Schutte, 1998), reported that students in a *virtual classroom* scored 20% higher than students in a traditional classroom ($p<0.001$). This paper describes the results of an investigation into the demographic and performance differences between students in an all web-based class in introductory statistics to students in a traditional classroom setting. It also presents some conclusions, recommendations and raises some questions requiring further study.

Introduction

A study at California State University at Northridge, (Schutte, 1997), (Black, 1997) & (Schutte, 1998), reported that students in a *virtual classroom* scored 20% higher than students in a traditional classroom ($p<0.001$). Professors at the University of Kentucky, reported a decrease in the failure rate of freshmen chemistry students using their web-based practice quizzes, (see Kiser & Toreki, 1997). Their work suggests that a web-based course could improve student retention and performance, at least in undergraduate mathematics and science courses.

Schutte speculates that the reason for the higher performance of his students in the web-based class is increased group interaction among students in a web-based class. Although he did not present data to support this finding, he concluded:

> "The number one residual finding of my study is that students placed in a virtual environment, performing the same work as classroom-based students, are more likely to engage others for help and understanding (not to be confused with collaboration or group tasking, as is done in Neal's review) than are students placed in a face-to-face environment where constant contact is the norm."
>
> (Schutte, J. G. 1998)

Ed Neal and others have criticized the research design and methodology of Schutte. Neal writes:

> "Unfortunately, Schutte's research design and methodology are so flawed that the results of the study are uninterpretable."
>
> (Neal, E. 1998)

(Schutte, 1998), counters the criticism of Neal and others. It appears that much of the criticism and debate may be precipitated by a general lack of rigorous, well-designed studies of web-based learning. The primary purpose of this study was to attempt to replicate the results reported by Schutte and to investigate the advantages and disadvantages of a web-based class. The major objectives can be summarized as:

1. To evaluate the performance differences between students in an all web-based class and those in a traditional classroom setting when students are allowed to select the course they prefer,
2. To evaluate the hypothesis that the background of students who prefer to enroll in an all web-based course is not different from those who prefer to enroll in a traditional class, and
3. To identify what advantages, if any, the technology used in a web-based class enhances the learning objectives of an introductory statistics course.

Methodology

Since, the experiment described by Schutte detailed a remarkable claim of success by the virtual classroom, a similar, but larger, study has been conducted at Texas A&M University Corpus Christi with a similar protocol. During the Fall of 1997, 89 students enrolled into two sections of an introductory statistics course, one taught in a traditional classroom and the other taught entirely via the Internet.

Similar to the Schutte study, this was an undergraduate statistics class. Likewise, the web-based class used the same general means employed by Schutte – lecture notes, on-line quizzes, a discussion listserver, email and biweekly live web classes (chat sessions). (Schutte, 1998) reported that his server crashed 14 times during the semester. In this study, the server was only off-line for 4 hours during a scheduled power outage. In addition, the lecture notes over the more difficult material were served as a PowerPoint lecture with synchronized audio; Real Audio compressed to server over a 28.8k modem connection (visit http://stat.tamucc.edu/m2342/chap12/xrchart/ for an example lecture).

However, unlike the Schutte study, the students were not randomly divided between the classes. Instead, students registered for the class of their choosing during normal registration. This was done since:

1. an objective of this study was to evaluate differences in demographics between students who prefer to enroll in a web-based class and those that do not, and
2. it was felt that it would be unfair to force students into the web-based class since it required some familiarity with the use of a web-browser and convenient access to the Internet.

To account for the non-random assignment of students to these classes, the overall university GPA of all students was recorded and all students completed test A/4F distributed by the Mathematical Association of America on college-level algebra, the only prerequisite for the course. This same test is administered every semester to incoming freshman, providing a large database of information about the average scores on this test and how they correlate with student performance in introductory statistics and other mathematics courses.

In addition, both classes ran concurrently for 15 weeks and were taught by the same instructor. Both covered the same content, had the same homework assignments, used the same text, Elementary Statistics by (Triola, 1997), and followed the same syllabus (visit http://stat.tamucc.edu/classes/m2342.html for the syllabus). Grades were based upon the same three written in-class, multiple-choice examinations administered at weeks 5, 10 and 15. The week 15 exam was the final exam which was a 2.5 hour comprehensive examination. Both classes took these examinations under the same conditions, and student names were obscured during grading to minimize testing bias.

The primary dependent variables under analysis were:

1. Student demographics - age, GPA, completed hours, and pretest scores
2. Scores on the three, in-class, multiple-choice in-class examinations
3. Student withdrawal and passing rates

Student demographics (1) were compared using the Wilcoxon test. Examination scores (2) were compared using the repeated measures analysis of covariance. This analysis was conducted both with and without the use of the covariates - GPA and algebra pretest. Withdrawal rates (3) were compared using Fisher's exact test. All calculations were done using the Statistical Package for the Social Sciences, SPSS version 8.0 (visit http://www.spss.com for a description), and all were conducted using a significance level of 0.05.

Comparison of Student Demographics

As (Table 1) indicates, the students who enrolled in the all web-based class were somewhat more mature students. The web-based class was statistically significantly older than the traditional class ($p<0.001$).

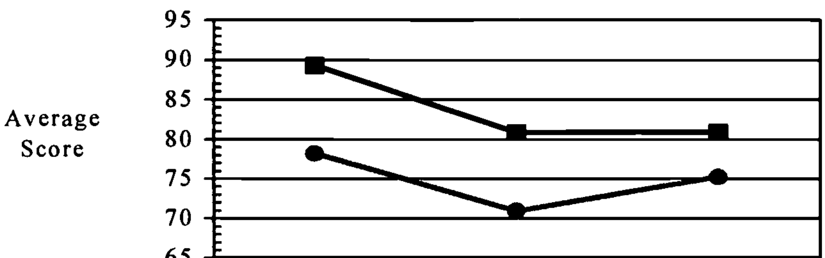
Likewise, they had a higher GPA and had completed more university hours. However, the differences in GPA and university hours for enrolling students were not statistically significant. Interestingly, although the students in the web-based class had an average GPA about 7% higher than the traditional class, their algebra pretest scores were only about 2% higher.

	Number of Students	Avg. Algebra Pretest	Avg. GPA	Avg. Univ. Hours Completed	Avg. Age
Web-Based Class	33	18.7	2.93	80.5	29.6
Traditional Class	56	18.3	2.72	68.6	22.9
Wilcoxon p-value		0.891	0.081	0.079	<0.001

Table 1: A comparison of demographics for enrolling students.

Comparison of Examination Scores

The following figure depicts the average scores between the two classes for the three major examinations. On average, the web-based class did score higher than the traditional class. Notice, however, that the difference between the two classes appears to narrow as the semester proceeded.



	Week 5 Exam	Week 10 Exam	Final Exam
Web-Based	89.3	80.8	80.9
Traditional	78.2	70.9	75.2

Figure 1: Average Unadjusted Examination Scores

Source	Df H	Df E	F-test	p-value
Exams	2	66	7.99	<0.001
Classes	1	67	7.14	0.009
Exams by Classes	2	66	1.28	0.289

Table 2: Repeated measures analysis of variance (ANOVA) of examination scores.

The repeated measures ANOVA, (see Table 2), of the examination scores indicates that the difference in examination scores is statistically significant (p=0.009). However, these differences can be explained by the higher average GPA and pretest scores of the web-based class.

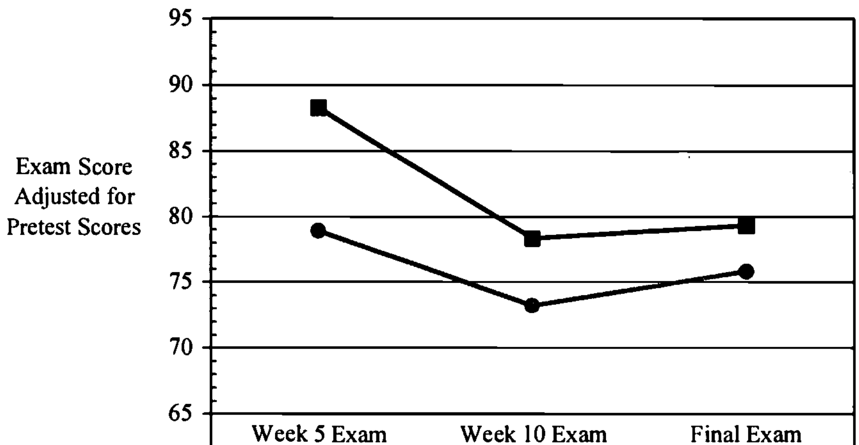
(Table 3) gives the same analysis using the pretest scores and student GPA as covariates. A graphical display of the least squares means from the adjusted analysis are displayed in (Figure 2) and (Figure 3). When the algebra pretest score is taken into account, the differences between the two classes narrowed to only 3% for the final examination, and the difference is no longer statistically significant (p=0.096). This is in spite of the fact that the difference in pretest scores among students finishing the course is not statistically significant (p=0.812), (see Table 5).

The difference between the two classes is even smaller when student GPA is taken into account (p=0.390), (see Figure 3). However, among students who completed the course, the web-based class did have a higher mean GPA (p=0.016), (see Table 5). Note that not only does the difference in adjusted scores

narrow as the semester proceeded, by the final exam, the average adjusted score for the traditional class was higher than the web-based class.

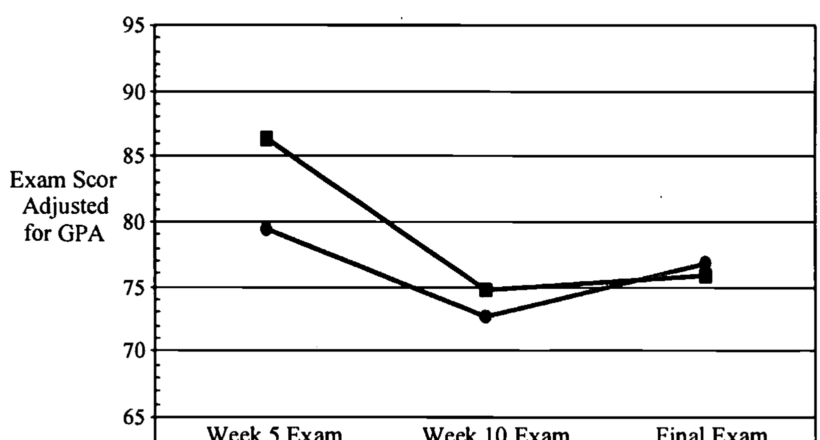
Source	p-value adjusting for algebra pretest scores	p-value adjusting for student GPA
Exams	0.023	0.066
Classes	0.096	0.390
Exams by Classes	0.379	0.152
Pretest	<0.001	<0.001

Table 3: Repeated measures Analysis of Covariance of examination scores.



	Week 5 Exam	Week 10 Exam	Final Exam
Web-Based	88.3	78.3	79.3
Traditional	78.9	73.2	75.8

Figure 2: Average examination scores, after adjusting for pretest scores



	Week 5 Exam	Week 10 Exam	Final Exam
Web-Based	86.3	74.7	75.9
Traditional	79.4	72.7	76.8

Figure 3: Average examination scores, after adjusting for student grade point average (GPA)

Comparison of Withdrawal Rates

At Texas A&M University Corpus Christi, students are allowed to withdraw from any course up to the last day of class without the instructors approval and without receiving a grade for the course on their transcript. It is not unusual to have a student who is passing a course withdraw from the course in the final weeks of the semester because of unforeseen personal circumstances or because they needed an "A" in the course to get into a medical school or a highly selective graduate program. Additionally, this course is a service course to science majors. That is, everyone taking this course is doing so because it is a required course outside the core courses of their particular major. This creates an environment with a higher than desired student withdrawal rate and a lower than desired passing rate.

	Total Students	Withdrew from Class	Percent Withdrawing	Number with Grade of C or Better	Percent with Grade of C or Better
Web-Based Class	33	9	27%	20	60%
Traditional Class	56	10	18%	37	66%
Fisher's p-value			0.301		0.652

Table 4: Comparison of withdrawal and passing rates.

The withdrawal and passing rates for the two classes are summarized in the above table. Although the differences in withdrawal and passing rates are not statistically significant, the web-based class did experience a higher withdrawal rate and a lower passing rate than the traditional class.

	Students Completing Course	Avg. Algebra Pretest	Avg. GPA	Avg. Univ. Hours Completed	Avg. Age
Web-BasedClass	24	19.1	3.04	75.3	30.7
Traditional Class	46	18.4	2.73	68.7	22.8
Wilcoxon p-value		0.812	0.016	0.344	<0.001

Table 5: A comparison of student demographics for students completing course using the Wilcoxon test.

The above table, (Table 5), describes that analysis of the demographics for students completing the course. Notice that although the average pretest scores and average university hours completed are still not statistically significantly different between the classes ($p=0.892$ & $p=0.344$ respectively), the average GPA of students completing the web-based class was about 11% higher than the traditional class ($p=0.016$).

Summary and Conclusions

(Schutte, 1997) reported that the students in his web-based class scored 20% higher than his traditional class. In this study, the difference between average scores on the final exam is only 6 points higher in the web-based class. Similar to the Schutte study, no statistically significant differences in GPA were seen among the students enrolling in the two sections ($p=0.081$). There was an even smaller difference between pretest scores ($p=0.891$). However, when the examination scores are adjusted for either the pretest scores or student GPA, differences in the average examination scores are no longer statistically significantly different ($p=0.379$ & $p=0.390$ respectively). Hence one would conclude that the higher average GPA of the students completing the web-based class could explain the 6% difference in the average score on the final exam.

This raises the question of why this study did not replicate the results of Schutte. It is unlikely that the lack of complete randomization in this study accounts for the different results since the students in the web-based class had better preparation, as measured by their pretest scores, GPA and number of completed university hours. This would have predicted an even larger advantage for the web-based class than that reported by Schutte.

Schutte also claims that students in a web-based class are more likely to "engage others for help and understanding." This was not seen in this study. In fact, every attempt to organize the web-based class around a team project and introduce them to one another was strongly resisted. Students complained that the reason they enrolled in the web-based class was for schedule flexibility and that it was too hard to coordinate schedules between students to meet as a team. Likewise participation in the class discussions on the listserver and the voluntary weekly live web-classes was poor. On average, only 15%-20% of students attended the live web-classes, although they were loyal and enthusiastic toward these classes.

It could be that the students in Schutte's classes were more motivated since his course was probably not a service course. Likewise, his students may have been younger and less involved raising families and working. In this study, the average age of the students completing the web-based class was 30.7. On average they were enrolled in 11.8 semester hours and were employed 22.3 hours per week. It can also be speculated that Schutte's teaching style may be more suited to a web-based class than a traditional class.

The major conclusion of this study is that the results reported by (Schutte, 1997) do not appear to be reproducible, at least with our student population. This also points to the need for further careful research into the best teaching methodology for web-based classes. It is unlikely that a simple translation of a course from a traditional classroom format to an all web-based class will improve or degrade student learning performance.

However, at Texas A&M Univ. Corpus Christi, we are continuing to offer web-based classes since they offer an alternative learning format that seems to be increasingly popular with a segment of our student population. Like many universities, we will continue to explore new teaching methodology for web-based classes.

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Model for Learning: Assessing Technology Effects on Student Learning

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Abstract:

Iowa Consortium for Assessment of Learning with Technology (ICALT) grew out of a shared interest in assessing student learning from classroom technology experiences. The group was initially started by a group of Area Education Agency (AEA) technology coordinators who shared an interest in technology planning. From the starting point of implementing and assessing technology planning in Iowa schools, the focus of the group became what some have called the *big question*: How does technology use in classrooms affect student learning? The purpose of this paper is to discuss the vision of ICALT, and the process of exploring the *big question* the group has initiated.

Clearly, technology is a part of a complex educational system, and it is impossible to separate the effects of technology use from the effects of other crucial pieces of the learning and teaching process (for example, the teacher, the curriculum, or additional materials). An assessment model will, however, help educators better define the specific purpose and role for using technology in the learning process. One of the barriers to assessing effects of technology use in Iowa schools has been that there is no cohesive set of goals for this use. Hardware has been purchased and some teachers have been trained, and now it is time to emphasize specific content-related goals for the use of technology in learning and teaching. Obviously, without emphasis on specific goals for technology use, it is almost impossible to measure what is occurring with student learning.

The Iowa Consortium for Assessment of Learning with Technology (ICALT) grew out of a shared interest in assessing student learning from classroom technology experiences. ICALT is a consortium of educators who are involved in leading Iowa in technology learning and teaching. Its membership includes AEA and LEA technology specialists, Department of Education personnel, Star Schools personnel, representatives from the Urban Eight, university professors working in technology and assessment, classroom teachers, and school administrators.

ICALT's mission is to design and implement a plan to assess the effects of technology use in Iowa classrooms on student learning. Its vision is to assist Iowa educators in implementing an approach to student assessment that provides useful feedback to students, teachers, families, community members, educators, legislators, and other interested parties on the effects of technology use in learning and teaching. The data from ICALT assessments will be used to continually modify and improve the classroom applications of technology to ensure that technology is being used to create experiences and outcomes that maximize its potential to improve and expand student learning. One of the outcomes of the ICALT assessment system will be to assist educators in determining appropriate goals for technology use in classrooms.

ICALT members believe that the current national standards efforts in specific content areas are closely aligned with areas where technology can be most useful in classrooms (for example, problem solving, project-based learning, emphasis on communication of results, and student projects). Thus ICALT has decided to use the National Council of Teachers of Mathematics (NCTM) standards as a starting point and to design an assessment system based on the use of technology to help facilitate the implementation of one of the NCTM standards. This will be a beginning model for more assessment efforts that will focus on technology use in other subject areas.

A graphic model has been developed to summarize ICALT's approach to assessment. The graphic illustrates that the model falls under the umbrella of school improvement and that within school improvement, particular standards should be selected by schools as targets for the impact of their work with technology. The graphic also illustrates ICALT's belief that using technology involves issues of both development and systems in the school. The development area includes both curriculum and professional development and the systems area includes resources, teacher beliefs and behaviors, and administrative support. The intersection of the two areas defines the school climate with respect to use of technology in learning and teaching. Assessment of learning with technology needs to address all the inputs into the system and reporting should be used to inform school improvement efforts. Finally, research should be used for decision making in all areas defined in the model.

With observations and focus groups with middle school students and teachers, both participants responded to what they have learned by emphasizing the problem solving, the collaboration, and the connections to real life. With the technology-rich learning environment, students and teachers were able to change the way they were doing things to include a richer learning beyond rote learning. One student wrote on her exam that she wanted to explain to her teacher what she was thinking when she completed the math problem. The energy radiating from the learning environment encouraged ICALT members to delve further into exploring the *big question:* How does technology use in classrooms affect student learning?

Does Electronic Communication Enhance Guided Reflection among Graduate Students?

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Abstract: This study followed 16 graduate students enrolled in a Reading/Language Arts Master's program through a semester of tutoring young readers. Because the literature suggests that students benefit from guidance in reflection, this study explored the effects of a guided reflection experience for graduate students. As participants explored ways to connect assessment and instruction in a clinical setting, they interacted with class peers and course instructors using electronic mail. E-mail offered participants a non-threatening forum to explore questions and concerns, successes, and perceived failures. Three interventions were implemented to guide participants in reflection about their teaching interactions. Data analysis consisted of triangulation of participant's e-mail interactions, observations of their teaching experiences, and analysis of specific written interactions. A majority of e-mail messages focused on requesting suggestions or ideas for upcoming lessons and discussing client problems. Additionally, several barriers to e-mail communications were identified by the subjects.

Significance

"Learning" has long been accepted as involving two aspects: first, the experience and second, one's reflection upon that experience. The idea that "you really don't understand what you know until you begin to examine it" (Whitford, Schlechty, & Shelor, 1987, p. 164) has become widely accepted in adult education circles, especially those dealing with teacher education. Beginning with Schon's (1983) work on the reflective practitioner, the teacher education literature has featured numerous calls for teachers to reflect upon their teaching as a way to take control of one's professional development and teaching success (cf. Ash, 1993; Vogt & Au, 1995). However, what is less clear is how one becomes reflective - and *how* one best selects the topics/events upon which to reflect to maximize professional growth.

In their work with preservice teachers, Stahlhut and Hawkes (1997) required students to select from three mediums for assigned weekly reflections: written journals, electronic mail (e-mail), and personal conferences with mentor teachers, peers, and university professors. Stahlhut and Hawkes found that students' choice of medium related to the problem they identified through their reflections. Students tended to use journals for sharing everyday teaching events with their cooperating teachers. They often relied on observation sessions

with their professors to address issues beyond the classroom (e.g., administrative questions or schoolwide concerns). Interestingly, students chose e-mail when they felt a sense of urgency about a specific issue and wanted to solve an immediate problem. While the authors were able to identify recurrent themes in student reflections, they noted that "student teachers need precise training related to the use of the reflection process" and that although "student teachers enjoyed having technology available to them because they got rapid feedback . . . there was no direct evidence the reflection process was improved because of e-mail communications" (1997, p. 5).

Because communication impacts all facets of education, educators search continually for economical, efficient, and expeditious communication methods to enhance students' learning. Telecommunications (i.e., e-mail) can be defined as the use of a computer, phone line, and modem (or alternative connection, i.e., cable) to send and receive messages as well as communicate with others asynchronously. E-mail represents a telecommunications system which is a mainstay in the business world and has been available on most large academic campuses for over a decade (Bull, Harris, Lloyd, & Short, 1989; D'Souza, 1992).

There are several advantages to using e-mail communication. Sending messages is fast with most transmissions taking only seconds. It is asynchronous communication where unlike conversations, both senders and receivers do not attend to the communication simultaneously (Broholm & Aust, 1994; D'Souza, 1992; Eiser, 1990). While advantages are quickly identified when implementing technology into courses or projects, there are also some barriers which need to be considered. Access to a computer has been identified as a major barrier in several projects (LaMaster & Tannehill, in press; Tannehill, Berkowitz, & LaMaster, 1995; Thompson & Hamilton, 1991; Zack, 1995). Participants tend to interact more often when they have a convenient access to a computer and electronic communication. Lack of comfort or familiarity with computer technologies has also been cited as a major barrier to using telecommunications (Nantz & Wilkins, 1995; Thompson & Hamilton, 1991; Zack, 1995).

As e-mail has become more commonly used among university colleagues the realization of increased speed and effectiveness provided opportunities for researchers to examine further possibilities. Use of telecommunications to supplement classroom communication and to seek information became more common (Durham & Sunal, 1991; D'Souza, 1991; Poling, 1994; Schrum, 1988, 1991). The major benefit of most of these projects has been increased professor access through e-mail messages. E-mail enables extended student-teacher communication beyond the confines of office hours and class time. Given 16 graduate students in a clinical setting, we could see clear benefits of providing access to the professor beyond the Reading Center hours.

Telecommunication systems also include electronic listservs which allow group interaction through public message posting. A listserv is a list consisting of individuals with e-mail accounts who have a common interest. Individual e-mail addresses are added to the list and once on the list they will receive any messages sent to the listserv. Listservs are a way to "reach out" to other educators that are on line, or connected to the system (Kearsley & Lynch, 1992). A major benefit of listservs is that messages can be posted for anyone to read and respond, with no need to coordinate time schedules (Bishop-Clark & Huston, 1992). For this project, four listservs were set up with graduate students assigned according to client needs. Our intent was this would provide our graduate students with a natural communication need as they sought to understand the characteristics of a client, they could turn easily to their on-line peers for help and advice.

After reviewing the possible benefits and challenges of electronic communication, we believed it would offer a useful communication channel for our inquiry. We posited, based on past experiences, that our graduate students would be geographically scattered, busy, and task-oriented. The opportunity to reflect with others through an electronic listserv would ideally provide a way for graduate students to explore and respond to compelling questions about tutoring their students in the Reading Center.

Study Purpose

Vogt and Au (1995) note that encouraging reflection among teachers takes time, and Dynak, Whitten, & Dynak (1997) suggest that wise use of collaboration enhances the process. Thus, in order to facilitate

cooperative reflection among university instructors as well as university students, this project was conceived as a team effort between two assistant professors from two different academic disciplines, both of which involve teacher education: Reading/Language Arts and Exercise and Nutritional Sciences.

This project ran for 16 weeks, building on a previous 1-semester course taught by the same Reading/Language Arts instructor. Three focus questions formed the foundation of this study:

1. What reflection themes do graduate students enrolled in a Reading/Language Arts Master's program exhibit at the beginning of their clinical reading experience?
2. How are the responses of graduate students influenced by explicit attempts to guide their reflections along two specific paths (reading/language arts and exercise/movement)?
3. How are graduate students' reflections demonstrated in electronic mail interactions as compared with formal lesson plans and other written materials?

Data Sources & Methods

The participants for this study were 16 volunteer graduate students enrolled in the Reading/Language Arts Master's program. These graduate students participated in a clinical reading experience throughout the study. During the course, graduate students worked in small groups and individually with learners experiencing difficulty with reading. Prior to the beginning of the study participants were asked to complete a permission form to release data to the study, a project contract, pretest scenarios, and send an e-mail message to the primary investigators. This initial e-mail message confirmed that all subjects had obtained an e-mail account and had basic understanding of e-mail.

Participants were assigned to four listservs according to their clients' ages and characteristics. The primary researchers were included on all four of the lists to monitor and provide guided reflection. Four separate lists were created so subjects would not be overwhelmed by the amount of messages generated throughout the 16-week study. At least once a week, participants posted to their class lists reflections on their teaching and interaction with their learners. Peers read and responded to postings throughout the week leading up to the next teaching opportunities. All participants were urged to maintain communication with their peers through the e-mail class lists.

A two-week baseline of graduate students' reflection patterns on e-mail occurred at the beginning of the project. Following this baseline a series of three interventions were implemented. The first intervention was conducted by the reading/language arts specialist who suggested ways to better instruct learners (reading and language arts strategies) and reflect on personal practice. The second intervention was conducted by the physical education pedagogy specialist. The final intervention was a combination intervention in which both specialists provide pedagogical feedback to the subjects. Each intervention was separated by a one-week baseline during which no explicit guided reflection suggestions were offered by the specialists.

Instruments

In addition to the e-mail methods described above, two other instruments were created for this study. In order to assess graduate students' typical views about the integration of movement with reading/language arts instruction, graduate students read and responded in writing to three brief scenarios that could arise in the Reading Center. They were asked to describe and rank three teaching interventions they would use in the given situation. They responded to the scenarios again at the conclusion of the study.

A checklist was created and used while supervising participants' actual instruction to clients at the Reading Center. This checklist included key aspects of guided reflection feedback given by each instructor to enable supervisors to ascertain possible enactment of particular suggestions.

Data Analysis and Findings

A grounded theory approach was used for data analysis of e-mail entries, formal lesson plans, scenarios, end-of-semester reflections and other related artifacts (Strauss & Corbin, 1990). Three goals directed the data analysis: 1) to identify the reflection themes graduate students engaged in throughout the study; 2) to determine whether graduate student reflections changed during the intervention periods of the study; 3) to determine how graduate students' reflections were demonstrated in e-mail interactions as compared with formal lesson plans and other written materials. Because this study spanned 16 weeks, opportunities for triangulation (Lincoln & Guba, 1985) occurred naturally and varied over time. Three independent researchers read and categorized e-mail messages into emerging categories. After consultation and discussion 100% agreement was achieved.

Additionally, information gained from the pre- and post-test scenarios and the observation checklists aided researchers in confirming emerging hypotheses. Scenarios were read and coded as to determine the suggested strategies for intervention with the client. Movement and technology references were of concern to the researchers and were compared between the pre and post test scenarios.

Discussion

Several barriers impeded the initial e-mail communications including lack of access, remote connection problems, and novice computer skills. However, a majority of graduate students did send e-mail messages throughout the study. Fourteen categories were thematically identified by the researchers and included; greetings, requests, guided reflection, reflection, movement, direct response, problem, rapport, groupness, strategy, technology, information, future, and out of clinic/teaching related. A majority of messages sent to the listserv focused on requesting suggestions or ideas for upcoming teaches and discussing their client problems. It was noted that listserv communications seldom focused on teaching strategies or teaching reflection unless guidance was provided by the course professor. Even after e-mail interventions minimal reflection occurred on-line. One possible explanation could be there were several first year teachers in the class and they frequently expressed a concern for keeping up with the demands on their time. Additionally, this group of graduate students had several courses together and could converse often which may have impacted their lack of sharing using e-mail.

Group e-mail communication patterns emerged during the study. One of the more experienced and verbally reflective students summarized something we saw repeatedly across all four groups - the tendency to use e-mail for communication rather than reflection: "I guess I found myself using e-mail when I had to communicate something, and not necessarily to process or reflect." Unique patterns among groups included a tendency to focus on a particular issue or type of interaction pattern. One group focused on technology while another focused on activities they were doing with their clients.

Written lesson plans revealed a higher level of reflection than found on e-mail. Researchers believe there may be several factors impacting this disparity between written and e-mail reflection including comfort level with technology and the peers on their listserv. Comparison of the pretest and posttest scenarios indicates that these graduate students were able to identify more teaching strategies upon completion of the Reading Center course. However, it was also noted that there was a decrease in the use of movement strategies in the written teaching interventions between pre and posttest scenarios.

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Proving Our Case While Avoiding Type I Errors

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Abstract: Educational Psychologist Richard Lookatch wrote in the Summer 1995 edition of TECHNOS that research literature that he had monitored since the early 1980's had never established that using technology improved learning. His analysis was that all of the studies were flawed with Type I errors. Mr. Lookatch's sweeping generalizations tend to overlook the value of many initial studies into the new field of computer and technology enhanced learning. The author's dissertation research avoided both Type I and Type II errors.

A few years ago, Educational Psychologist Richard Lookatch wrote in the Summer 1995 edition of TECHNOS that research literature that he had monitored since the early 1980's had never established that using technology improved learning. His analysis was that all of the studies were flawed with Type I errors, finding benefits that really were not there, as summarized in the November 1995 edition of Education Digest (Lookatch, 1995).

As the author was planning his dissertation research in Instructional Technology under Dr. Charles Dickens of Tennessee State University, Nashville, he was made aware of the necessity of avoiding both Type I and Type II errors by several of his professors. Dr. Carol Stice impressed upon her class in Research Methods that researchers can only conclude within a stated probability of error that the decision to reject the null hypothesis is the correct decision. As there is always a possibility that the decision reached by the researcher is wrong, two kinds of incorrect decisions can be made (Crowl, 1996).

In Type I errors, the researcher incorrectly concludes that the null hypothesis should be rejected, when in actuality there really is a significant difference between the means -- too different to be the result of chance error. In Type II errors, the researcher incorrectly concludes that the null hypothesis should not be rejected, when in actuality there really is not a significant difference between the means (Crowl, 1996; Gay, 1981).

Type I and Type II errors usually occur when the study is constructed in such a way as to ignore established rules of proper research. Whereas Type I errors involve setting the level of significance in data analysis so low as to find benefits that are not really present, Type II errors involve setting the level of significance in data analysis so high that benefits that are really present are overlooked. Failing to control for a host of conditions that may account for the observed impact on learning also leads to Type I errors (Crowl, 1996).

The author's 1998 research study took place in about a dozen 4th grade classrooms over a period of almost three months. During this time, weekly lesson plans were developed by the author and implemented by the classroom teachers of the six treatment classes. The treatment used social studies simulation software and the Internet, integrated into the regular curriculum in one-computer classrooms. Teacher training was provided and weekly contact was made with each of the treatment classrooms and their teachers.

Through the guidance of Dr. Charles Dickens, the author's dissertation research avoided both types of errors. Type II errors were avoided by setting the level of significance at the .05 level, but the actual outcomes of the study showed the data analysis definitely avoided the Type I error as well. The ANCOVA results of the pre-test and post-test data were extremely significant in proving that the author's treatment could impact critical thinking.

Mr. Lookatch's sweeping generalizations that all of the studies that he had reviewed contained a fundamental flaw, i.e. Type I errors, tends to overlook the value of many of these initial studies into this new field of computer and technology enhanced learning. Certainly, the pressure is there for researchers to overstate their case, but scholarly journal review boards and dissertation committees have an obligation to ensure that the research is properly conducted and adequately reported. Such was the fulfillment of the duties of the author's dissertation committee and of his dissertation chair, Dr. Charles Dickens. The author's research findings are statistically significant and stand upon their own merits.

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GENDER DIFFERENCES ON ATTITUDES TOWARD COMPUTERS: A META-ANALYSIS

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Abstract: A meta-analysis was performed to synthesize existing research of gender differences on attitudes toward computers. One hundred and six studies were located from three sources, and their quantitative data were transformed into Effect Size (ES). The overall grand mean of the study-weighted ES for all 106 studies was 0.19. The results suggest that male subjects had slightly higher attitudes toward computer female subjects. While many authors have indicated that women and girls are more likely to hold lower attitudes toward computers (e.g., Jagodzinksi & Clarke, 1986), the results of this study provide an accumulated research-based evidence to support this hypothesis. Left unanswered is the question of what factors truly contribute to the differences. Studies of this question will require further clarification of the exact relationship between gender and computer learning. This meta-analysis points out only that gender differences on attitudes toward computers exist.

Computer attitudes usually refer to people's reactions to computers. These reactions include liking about, confidence to use, belief about the usefulness of, sex stereotype of, and ability stereotype of computers. As computers have been increasingly used in our society, many studies have reported people's attitudes toward computers (e.g., Campbell, 1992; Chu & Spires, 1991; Gordon, 1993; Kay, 1993; Whitley, 1996). In particular, much research effort has gone into looking at gender differences and their causes on computer attitudes (e.g., Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994). This issue is critical since the U.S Department of Labor had predicted that by 1995 at least 2 million people would be in occupations related to computers and millions of others would be using computers as part of their jobs (Armitage, 1993). Nowadays, it is reasonable to believe that the number of people who need to use computers to fulfill their job requirements is much more than in 1995.

Computer use has been portrayed in our society as more appropriate to men and boys than women and girls (Whitley, 1997). Computer games and educational software have been designed to appeal more to boys than girls (Kiesler, Sproull, & Eccles, 1985). Computer use in schools has also been linked to traditionally 'masculine' subjects such as science and mathematics but not to traditionally 'feminine' subjects such as art and literature (Hawkins, 1985). These gender differences in socialization have led to the hypothesis that women and girls are more likely to hold more negative attitudes toward computers.

Although many studies have been conducted on this hypothesis (Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994), the results of existing studies have reported a confusing picture. For example, Campbell (1990), Chen (1986), Colley, Gale, & Harris (1994), Jacobson (1991), Loyd & Gressard (1986), Wallace & Sinclair (1995), Whitley (1996a;1996b), and Woodrow (1994) all reported significantly higher computer attitudes for males than females, while Blumer (1987), Campbell (1986;1989), Cantrell (1995), Chu & Spires (1991), Francis (1994), Koohang (1987;1989), Loyd & Gressard (1985), Loyd, Loyd, & Gressard (1987), Mertens & Wong (1988), Pope-Davis & Twing, and Robertson, Calder, & Jones (1995) have indicated that there is little, if any, differences of computer attitudes between males and females. Owing to the mixed evidence provided by existing research in the area, this study attempts to use the meta-analytic approach to investigate the gender differences on attitudes toward computers. The results from this meta-analysis will help provide clearer conclusion.

PROCEDURES

The research method used in this study is the meta-analytic approach which was similar to that described by Glass, McGaw, & Smith (1981). The studies considered for use in this meta-analysis came from three major sources and were published from 1984 to 1997. One large group of studies came from computer searches of Education Resources Information Center (ERIC). A second group of studies came from Comprehensive Dissertation Abstracts. A third group of studies was retrieved by branching from bibliographies in the documents located through review and computer searches. One hundred and six studies were located through these search procedures; 19 studies came from ERIC and conference proceedings, 80 studies were retrieved from published journals, 7 studies were from Comprehensive Dissertation Abstracts..

Several criteria were established for inclusion of studies in the present analysis.

1. Studies had to assess the differences between males and females on computer attitudes.
2. Studies had to provide quantitative results from both male and female subjects.
3. Studies had to be retrievable from university or college libraries by interlibrary loan or from ERIC, Dissertation Abstracts International, or University Microfiche International.

There were also several criteria for eliminating studies or reports cited by other reviews: (a) studies did not report sufficient quantitative data in order to estimate Effect Sizes; (b) studies reported only correlation coefficients -- r value or Chi-square value; (c) studies could not be obtained through interlibrary loans or from standard clearinghouses.

Outcome Measures

The outcome measured most often in the selected studies was survey data from participants, as indicated in various instruments for examining participants' computer attitudes. For statistical analysis, outcomes from a variety of different studies with a variety of different instruments had to be expressed on a common scale. The transformation used for this purpose is the one recommended by Glass et al. (1981). To reduce measurements to a common scale, Glass and his colleagues coded each outcome as an Effect Size (ES), defined as the difference between the mean scores of two groups divided by the standard deviation of the control group. For those studies that did not report means and standard deviations, F, or t, values were used for estimating the ES.

In most cases, the application of the formula given by Glass and his colleagues was quite straightforward. But in some cases, when more than one value was available for use in the formula of ES, the value, which measured outcomes most correctly, was selected. For example, some studies reported both differences on pretest measures and differences in posttest measures. In such cases, pretest measures were selected for estimating ES so that any treatment which may change participants' general feelings about computers could be avoided.

In other cases, several subscales and subgroups were used in measuring a single outcome (e.g., those that reported separate data by ethnicity or grade). In such cases, each comparison was weighted in inverse proportion to the number of comparisons within the study (i.e., 1/n, where n = number of comparisons in the study) so that the overweighing of ES of a study could be avoided (see, for example, Waxman, Wang, Anderson, & Walberg, 1985, p. 230).

Variables Studied

Nine variables were selected for coding each study in the present synthesis. These variables are listed in Table 1. The first 2 variables were coded so that potential different effects for subjects with different background could be detected. The following 2 variables (i.e., type of publication and year of publication) were coded because it is important to know how effects are related to sources of information over time. The next 4 variables were coded so that effects related to characteristics of research design could be detected. The last variable was coded because it is critical to know how effects are associated with different types of attitudes. Each variable was employed as a factor in an analysis of variance (ANOVA) to investigate whether there were significant differences within each variable on the effect size.

Variables
Nation of Subject
Population Group
Type of Publication
Year of Publication

Sample Size
Reliability of Measure
Statistical Power
Statistics
Type of Attitude

Table 1. Coded Variables for the Meta-analysis

RESULTS

Of the 106 studies included in the present synthesis, 85 or 80% of the study-weighted ESs were positive and favored the male subjects, while 21 or 20% of them were negative and favored the female subjects, indicating that males had lower computer anxiety than females. The range of the study-weighted ESs was from -0.85 to 0.881. The overall grand mean for all 106 study-weighted ESs was 0.192. When this mean ES was converted to percentiles, the percentiles on computer attitudes were 58 for the male subjects and 50 for the female subjects. The standard deviation of 0.286 reflects the small variability of ESs across studies.

Among the 489 ESs included in the present synthesis, 363 or 74% were positive and favored the male subjects, while 121 or 25% were negative and favored the female subjects. Only 1 or 1% of the ESs indicated no difference between male and female subjects. The range of the ESs was from -0.85 to 0.881.

Table 2 lists the F values for the 9 variables for all study-weighted ESs in the study. Descriptive statistics for the 9 variables are presented in Table 3. The positive means for liking, belief/usefulness, confidence, and mixed indicate more positive attitudes favor male subjects; however, for sex stereotype and ability stereotype, the positive means indicate a higher sex and ability stereotype for male subjects.

For ANOVA, 1 variable, type of attitude, showed statistically significant impact. The post hoc test for type of attitude, ($F(6,232) = 2.554$, $P<.05$), showed that the mean comparison of studies that measured sex stereotype was significantly higher than studies that measured liking, anxiety, belief/usefulness, confidence, ability stereotype and mixed attitudes. In addition, the mean comparison of studies that measured belief was significantly higher than studies that measured mixed attitudes.

Variables	*df*	*F*	*p*
Nation of Subject[a]	1, 108	1.964	0.164
Population Group[a]	4, 111	0.684	0.605
Sample Size	3, 102	0.588	0.624
Type of Publication	2, 103	0.859	0.427
Year of Publication	4, 101	1.094	0.364
Reliability of Measure	2, 103	0.509	0.603
Statistical Power	2, 103	0.070	0.932
Statistics	2, 103	1.742	0.180
Type of Attitude[a]	6, 232	2.554	0.021*

p<.05
Note. a Some studies reported more than one comparison groups.

Table 2. Results of ANOVAs for Coded Variables

Variables	N	%	ES	SD

Nation of Subject[a]				
USA	86	78.2	0.205	0.296
Non-USA	24	21.8	0.114	0.219
Population Group[a]				
K – Elementary	7	6.2	0.181	0.347
Secondary	27	21.2	0.141	0.303
College	50	44.2	0.221	0.254
Teacher & Adult	17	15.0	0.109	0.301
Mixed	15	13.3	0.162	0.257
Sample Size				
Less than 200	35	33.0	0.207	0.398
201 – 400	38	35.8	0.178	0.227
401 – 1000	23	21.7	0.235	0.216
Over 1000	10	9.4	0.098	0.126
Type of Publication				
Journal article	80	75.5	0.172	0.291
Dissertation/thesis	7	6.6	0.288	0.277
ERIC & Conference	19	17.9	0.241	0.269
Year of Publication				
1983 – 1985	10	9.4	0.142	0.269
1986 – 1988	29	27.4	0.208	0.265
1989 – 1991	20	18.9	0.09	0.351
1992 – 1994	26	24.5	0.216	0.252
1995 – 1997	21	19.8	0.262	0.294
Reliability of Measure				
Actual reliability figure	85	80.2	0.188	0.262
Adequate indication	4	3.8	0.333	0.607
Unspecified or inadequate	17	16.0	0.178	0.322
Statistical Power				
Adequately minimized	85	80.2	0.195	0.235
Probably threat	20	18.9	0.187	0.457
Inadequate or Unspecified	1	0.9	0.089	0.000
Statistics				
Mean & Standard deviation	77	72.6	0.166	0.303
t - value	8	7.5	0.172	0.213
F - value	21	19.8	0.296	0.227
Type of Attitude[a]				
Anxiety	42	17.6	0.096	0.226
Belief/Usefulness	31	13.0	0.020	0.100
Confidence	53	22.2	0.088	0.124
Liking	49	20.5	0.070	0.094
Ability-related Stereotype	6	2.5	-0.030	0.115
Sex-related Stereotype	20	8.4	0.193	0.277
Mixed	38	15.9	0.105	0.235

Note. a Some studies reported more than one comparison groups.

Table 3. Means and Standard Deviations of Study-weighted ES for Coded Variables

DISCUSSION

The results of this meta-analysis indicate that, overall, male subjects had slightly higher computer attitudes than female subjects. An effect is said to be small when ES = 0.2, medium when ES = 0.5 and large when ES = 0.8 (Cohen, 1977). Eighty percent of positive study-weighted ES values and 74% of positive ESs

overall also confirm the gender differences on computer attitudes. The slightness of the differences must be keep in mind, however; the overall study-weighted mean ES of 0.192 only indicates 8 percentile scores higher than the female subjects. The percentile scores for the overall grand mean and median were identical, reflecting the small variability of ESs across studies.

The significant differences found among the mean comparison of studies that measured sex stereotype and studies that measured liking, anxiety, belief/usefulness, confidence, ability stereotype and mixed attitudes were quite interesting. It is possible because male subjects hold higher sex-related stereotype toward computer use, and this tendency influences female subjects' feelings about computers that results in females' overall more negative attitudes toward computers. In short, the gender differences on sex-related stereotype toward computer use may be the key factor that yields the gender differences on overall attitudes toward computers. More studies need to be addressed on this hypothesis.

CONCLUSION

Although many studies have been conducted to examine the hypothesis that women and girls are more likely to hold more negative attitudes toward computers (Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994), and still fail to get a clearer picture, the results of this study provide an accumulated research-based evidence to support this hypothesis. Left unanswered is the question of what factors truly contribute to the differences. Studies of this question will require further clarification of the exact characteristics of each type of computer attitude (e.g., anxiety, confidence, and sex-related stereotype) and their relationships with gender. This meta-analysis points out only that gender differences on attitudes toward computers exist. That information by itself is useful.

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GENDER DIFFERENCES ON COMPUTER ANXIETY: A META-ANALYSIS

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Abstract: A meta-analysis was performed to synthesize existing research of gender differences on computer anxiety. Forty-one studies were located from three sources, and their quantitative data were transformed into Effect Size (ES). The overall grand mean of the study-weighted ES for all 41 studies was 0.28. The results suggest that male subjects had slightly lower computer anxiety than female subjects. While many authors have indicated that women and girls are more likely to hold higher anxiety toward computers (e.g., Jagodzinksi & Clarke, 1986), the results of this study provide an accumulated research-based evidence to support this hypothesis. Left unanswered is the question of what factors truly contribute to the differences. Studies of this question will require further clarification of the exact relationship between gender and computer learning. This meta-analysis points out only that gender differences on computer anxiety exist.

As computers have been increasing used in modern American society, many studies have reported people's attitudes toward computers (e.g., Campbell, 1992; Chu & Spires, 1991; Gordon, 1993; Kay, 1993; Whitley, 1996a). In particular, much research effort has gone into looking at gender differences and their causes on computer anxiety (e.g., Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994). The computer anxiety is refereed to a "phobic" response that inhibits people from interacting with computers (Pope-Davis & Twing, 1991). Many authors have suggested that negative reactions to computers (such as computer anxiety) are associated with the failure of particular computer applications (e.g., Jagodzinksi & Clarke, 1986). Elkins (1985) notes that teachers' attitudes toward computers are critical to the successful implementation of such system in special education classes.

Computer use has been portrayed in our society as more appropriate to men and boys than women and girls (Whitley, 1997). Computer games and educational software have been designed to appeal more to boys than girls (Kiesler, Sproull, & Eccles, 1985). Computer use in schools has also been linked to traditionally 'masculine' subjects such as science and mathematics but not to traditionally 'feminine' subjects such as art and literature (Hawkins, 1985). These gender differences in socialization have led to the hypothesis that women and girls are more likely to hold higher anxiety toward computers.

Although many studies have been conducted on this hypothesis (Blumer, 1987; Campbell, 1988; 1989; Chen, 1986; Koohang, 1989; Loyd & Gressard, 1986; Meier, 1988; Wallace & Sinclair, 1995; Woodrow, 1994), the results of these studies are mixed. For example, Campbell (1990), Chen (1986), Colley, Gale, & Harris (1994), Jacobson (1991), Loyd & Gressard (1986), Wallace & Sinclair (1995), Whitley (1996a;1996b), and Woodrow (1994) all reported significantly higher computer anxiety for females than males, while Blumer (1987), Campbell (1986;1989), Cantrell (1995), Chu & Spires (1991), Francis (1994), Koohang (1987;1989), Loyd & Gressard (1986), Loyd, Loyd, & Gressard (1987), Mertens & Wong (1988), Pope-Davis & Twing (1991), and Robertson, Calder, & Jones (1995) have indicated that there is little, if any, differences of computer anxiety between males and females. Owing to the mixed evidence provided by existing research in the area, this study attempts to use the meta-analytic approach to investigate the gender differences on computer anxiety. The results from this meta-analysis will help provide clearer conclusion.

PROCEDURES

The research method used in this study is the meta-analytic approach which was similar to that described by Glass, McGaw, & Smith (1981). The studies considered for use in this meta-analysis came from three major

sources and were published from 1984 to 1997. One large group of studies came from computer searches of Education Resources Information Center (ERIC). A second group of studies came from Comprehensive Dissertation Abstracts. A third group of studies was retrieved by branching from bibliographies in the documents located through review and computer searches. Forty-one studies were located through these search procedures; 9 studies came from ERIC and conference proceedings, 30 studies were retrieved from published journals, 2 studies were from Comprehensive Dissertation Abstracts.

Several criteria were established for inclusion of studies in the present analysis.

1. Studies had to assess the differences between males and females on computer anxiety.
2. Studies had to provide quantitative results from both male and female subjects.
3. Studies had to be retrievable from university or college libraries by interlibrary loan or from ERIC, Dissertation Abstracts International, or University Microfiche International.

There were also several criteria for eliminating studies or reports cited by other reviews: (a) studies did not report sufficient quantitative data in order to estimate Effect Sizes; (b) studies reported only correlation coefficients -- $\underline{r}$ value or Chi-square value; (c) studies could not be obtained through interlibrary loans or from standard clearinghouses.

Outcome Measures

The outcome measured most often in the selected studies was survey data from participants, as indicated in various instruments for examining participants' computer anxiety. For statistical analysis, outcomes from a variety of different studies with a variety of different instruments had to be expressed on a common scale. The transformation used for this purpose is the one recommended by Glass et al. (1981). To reduce measurements to a common scale, Glass and his colleagues coded each outcome as an Effect Size (ES), defined as the difference between the mean scores of two groups divided by the standard deviation of the control group. For those studies that did not report means and standard deviations, $\underline{F}$, or $\underline{t}$, values were used for estimating the ES.

In most cases, the application of the formula given by Glass and his colleagues was quite straightforward. But in some cases, when more than one value was available for use in the formula of ES, the value that measured outcomes most correctly was selected. For example, some studies reported both differences on pretest measures and differences in posttest measures. In such cases, pretest measures were selected for estimating ES so that any treatment which may change participants' general feelings about computers could be avoided.

In other cases, several subscales and subgroups were used in measuring a single outcome (e.g., those that reported separate data by ethnicity or grade). In such cases, each comparison was weighted in inverse proportion to the number of comparisons within the study (i.e., 1/n, where n = number of comparisons in the study) so that the overweighing of ES of a study could be avoided (see, for example, Waxman, Wang, Anderson, & Walberg, 1985, p. 230).

Variables Studied

Eight variables were selected for coding each study in the present synthesis. These variables are listed in Table 1. The first 2 variables were coded so that potential different effects for subjects with different background could be detected. The following 2 variables (i.e., type of publication and year of publication) were coded because it is important to know how effects are related to sources of information over time. Last 4 variables were coded so that effects related to characteristics of research design could be detected. Each variable was employed as a factor in an analysis of variance (ANOVA) to investigate whether there were significant differences within each variable on the effect size.

Variables
Country
Population Group
Type of Publication
Year of Publication
Sample Size
Reliability of Measure
Statistical Power
Statistics

Table 1. Coded Variables for the Meta-analysis

RESULTS

The number of comparisons and the study-weighted ESs are reported in Table 2. Of the 41 studies included in the present synthesis, 33 or 80% of the study-weighted ESs were positive and favored the male subjects, while 8 or 20% of them were negative and favored the female subjects, indicating that males had lower computer anxiety than females. The range of the study-weighted ESs was from -0.52 to 1.923. The overall grand mean for all 41 study-weighted ESs was 0.284. When this mean ES was converted to percentiles, the percentiles on computer anxiety were 61 for the male subjects and 50 for the female subjects. The standard deviation of 0.413 reflects the mild variability of ESs across studies.

Among the 55 ESs included in the present synthesis, 41 or 74% were positive and favored the male subjects, while 13 or 24% were negative and favored the female subjects. Only 1 or 2% of the ESs indicated no difference between male and female subjects. The range of the ESs was from -0.52 to 1.923.

Author(s)	Year	No. of Comparison	ES
Abler, & Sedlacek	1987	5	0.4772
Busch	1995	1	0.7760
Campbell	1988	1	-0.0305
Campbell	1989	1	-0.4360
Campbell	1990	1	-0.5196
Cantrell	1995	1	1.9229
Chen	1986	1	-0.1338
Chu, & Spires	1991	1	0.1899
Colley et al.	1994	1	0.5327
Dyck, Smither	1994	2	0.1271
Dyck, Smither	1996	1	0.7521
Gilroy, Desai	1986	1	0.5625
Francis	1994	1	0.1258
Gordan	1993	1	-0.1743
Heinssen et al.	1987	1	0.2189
Jacobson	1991	1	0.8502
Kluever et al.	1995	1	0.1159
Koohang	1986	1	0.3571
Koohang	1986	1	0.7238
Koohang	1987	1	0.1739
Koohang	1989	1	0.2263
Liao	1993	1	0.1471
Liao	1994	1	0.6264
Liao	1994	1	0.2540
Liao	1995	1	-0.0347
Loyd, & Gressard	1984	1	0.0731
Loyd, & Gressard	1986	1	0.5676
Loyd et al.	1987	1	-0.1498
Mackowiak	1988	1	0.0742
Makrakis	1992	1	0.1123
Meier	1988	1	0.2708
Mertens, & Wang	1988	1	-0.1472
Moon et al.	1994	1	0.1968
Pope-Davis, & Twing	1991	1	0.3349
Reed et al.	1995	4	0.0135
Ruth	1996	1	0.0686
Volman	1995	1	0.6364

Wallace	1995	1	0.6576
Whitley	1996	1	0.4166
Whitley	1996	1	0.4161
Woodrow	1994	1	0.2525
Overall grand mean			0.408
Overall grand median			0.147
Overall grand SD			0.874

Note. Total N of studies = 41. Total N of comparisons = 55

Table 2. Number of Comparisons and Study-weighted Effect Sizes

Table 3 lists the F values for the 8 variables for all study-weighted ESs in the study. Descriptive statistics for the 8 variables are presented in Table 4. For ANOVAs, 1 variable, type of publication, showed statistically significant impact. In addition, 1 variable, sample size, showed an approaching significant impact. For each of these variables, a post hoc (Fisher's Protected LSD) test was performed.

The post hoc test for type of publication, ($F(2,38) = 3.887$, $P<.05$), showed that the mean comparison of studies coded as dissertation (mean = 0.996) was significantly higher than studies coded as journal (mean = 0.22) or ERIC/conference (mean = 0.337). However, since there are only 2 studies that coded as dissertation, this result may be considered tentative.

For sample size ($F(2,38) = 2.915$, $p = 0.067$), the post hoc test showed that the mean comparison of studies in which the sample size was less than 200 (mean = 0.433) was significantly higher than studies in which the sample size was over 400 (mean =0.07). There were no significant differences found between the mean comparison of studies in which the sample sizes were less than 200 and 200 - 400 (mean = 0.255). The results seem to suggest that gender difference on computer anxiety may decline when the same size increases.

Variables	df	F	*p*
Country	1, 39	0.018	0.895
Population Group	2, 41	0.651	0.527
Sample Size	2, 38	2.915	0.066
Type of Publication	2, 38	3.887	0.029*
Year of Publication	3, 37	2.299	0.093
Reliability of Measure	2, 38	0.408	0.668
Statistical Power	1, 39	1.353	0.252
Statistics	2, 38	0.246	0.783

* p<.05

Table 3. Results of ANOVAs for Coded Variables

Variables	N	%	ES	SD
Country				
USA	36	87.8	0.290	0.433
Non-USA	5	12.2	0.263	0.229
Population Group[a]				
Elementary – High School	11	25.0	0.169	0.416
College	23	52.3	0.290	0.238
Adult 10	22.7	0.361	0.616	
Sample Size				
Less than 200	18	43.9	0.433	0.531
201 – 400	12	29.3	0.255	0.163

Over 400	11	26.8	0.07	0.291
Type of Publication				
Journal article	30	73.2	0.220	0.325
Dissertation/thesis	2	4.9	0.996	1.311
ERIC & Conference	9	22.0	0.337	0.111
Year of Publication				
1984 – 1987	10	24.4	0.287	0.301
1988 – 1991	10	24.4	0.081	0.397
1992 – 1994	10	24.4	0.220	0.225
1995 – 1997	11	26.9	0.522	0.554
Reliability of Measure				
Actual reliability figure	38	92.7	0.273	0.421
Adequate indication	1	2.4	0.658	0.000
Unspecified or inadequate	2	4.9	0.288	0.388
Statistical Power				
Adequately minimized	33	80.5	0.247	0.423
Probably threat	8	19.5	0.435	0.356
Statistics				
Mean & Standard deviation	33	80.5	0.305	0.430
t - value	1	2.4	0.271	0.000
F - value	7	17.1	0.182	0.375

Note. a Some studies reported more than one comparison groups.

Table 4. Means and Standard Deviations of Study-weighted ES for Coded Variables

CONCLUSION

The results of this meta-analysis indicate that male subjects had slightly lower computer anxiety than female subjects. An effect is said to be small when ES = 0.2, medium when ES = 0.5 and large when ES = 0.8 (Cohen, 1977). Eighty percent of positive study-weighted ES values and 74% of positive ESs overall also confirm the gender differences on computer anxiety. The slightness of the differences must be keep in mind, however; the overall study-weighted mean ES of 0.284 only indicates 11 percentile scores higher than the female subjects. The percentile scores for the overall grand mean and median were 61 and 59, respectively. The difference of 2 percentile points between them was possibly attributed to the overall grand standard deviation (0.413).

While many authors have indicated that women and girls are more likely to hold higher anxiety toward computers, and this negative reaction to computers may be associated with their failure of particular computer applications (e.g., Jagodzinksi & Clarke, 1986), the results of this study provide an accumulated research-based evidence to support this hypothesis. Left unanswered is the question of what factors truly contribute to the differences. Studies of this question will require further clarification of the exact relationship between gender and computer learning environment. This meta-analysis points out only that gender differences on computer anxiety exist. That information by itself is useful.

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THE INFLUENCE OF DIFFERENT TEACHING METHODS ON STUDENT ATTITUDES TOWARD TECHNOLOGY

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Abstract: Students' attitudes toward computer technologies have been found one of the important variables that influence their computer achievements. Research has shown that students' experience of using or learning computer technology influences their attitudes toward computer technology. The current study investigated the influences of different teaching methods on students' computer attitudes. Two teaching methods were used in this study: (1) teacher-centered instructive method, and (2) student-centered constructive method. Two groups of teacher education students served as the sample, each of which learned basic computer skills with one of the two teaching methods. Their computer attitudes were measured and compared in four attitude variables—enjoyment, motivation, importance, and freedom from anxiety. Differences were found between the two groups.

Introduction

Positive attitude toward computer technologies has been widely recognized as a necessary condition for effectively using and learning information technology (Woodrow, 1992: Knezek, Christensen & Rice, 1997), and student computer attitude has been found an important variables that influence computer achievement (Liu & Fernandez, 1998; Liu & Johnson, 1998). Therefore, to help students build up positive computer attitude becomes one of the critical issues in technology education. Research findings suggest that the instructional strategies a teacher used in teaching computer technologies influence student computer attitude (Dickens, 1998; Kovalchick, Milman & Hrabe, 1998).

The current study examined the influences of two teaching methods on student computer attitude. The two teaching methods were (1) teacher-centered instructive method, and (2) student-centered constructive method. Four computer attitude variables—enjoyment, motivation, importance, and freedom from anxiety—were measured and compared between two groups of students who learned computer technologies with different teaching methods.

Literature Review

Constructivism versus Instructivism

Conventional teacher-centered instruction has been in our classrooms for many years, it is now confronted with the challenge of the rapid development of technologies (Brooks, 1990). Constructivism has emerged in opposition to conventional teaching. Much educational research has been undertaken to find "*What Works*" in our classrooms, especially in our information technology classroom (Kerzer & Wright, 1997). To find the answer to this question, discussion of constructivism has been a theme widely spreading in the literature. What is constuctivism? This is the question from those who attempt to gain a meaningful understanding of the implication of comstructivism for teaching. The literature reflects wide-range of views. Jonassen (1996) describes a well-accepted definition of constructivism that learners construct their own reality through interpreting their experiences. Existing views also hold that constructivism is a collection of theories (Newby, Stepich, Lehman & Russell, 1996), and an instructional model (Roblyer, Edwards & Havriluk, 1997). These diverse perspectives provide educators with ideas regarding how constructivism may improve student learning.

Keizer and Wright (1997) introduced a constructivist model that was designed to maintain a quality with limited resources when the instructional technology faculty was faced with staff reductions and limited equipment for basic computer skills' instruction. Based on construvtivist principles, a course was specifically designed that essentially tripled the enrollment without increasing staff or the number of computers available. Using constructivism can, on one hand, effectively use the existing resource of technology. On the other hand, with the constructive method, students, instead of

teachers, can organize information, explore the learning environment, conduct learning activities, and monitor their learning—they learn technology by *doing*. Traditional way of teaching technology lessons is concept introduction, practice, application, and further exploration. But, learning based on constructivist principles follows a sequence in which exploration comes first (Brooks, 1990). In this learning process, learners create meaning and are not passive recipients of information (Roth, 1989).

Between the two approaches of teaching/learning, is constructive method better than instructive method in technology learning? Does constructive method work more effectively than instructive method? When should we use constructive method? When instructive method? Numerous studies have been undertaken to find the answers. However, few studies have occurred regarding these questions: what impacts might the constructivist perspective have on teacher education students' attitudes toward computer technology? From which teaching approach could more positive computer attitude be derived? The current study was to investigate the impacts of different approaches on students' computer attitudes.

Computer Attitude Variables

Students' attitudes toward computer technologies have been found to be one of the major factors relating to their success in learning about and using them (Francis & Evans, 1995; Freedman & Liu, 1996; & Liu & Johnson, 1998). Computer attitude can be viewed as a many-faceted variable, for it is difficult to define a single variable called attitude. Studies have focused on investigating computer users' attitudes in relation to one or more variables, such as (1) *enjoyment*—the degree in which students are interested in, and like learning and working with a computer (Cooper & Stone, 1996; King & Bond, 1996); (2) *motivation*—the degree to which students are willing to learning and working on the computer (Kellenberger, 1996); (3) importance—the extent to which students feel learning and using the computer is important; and (4) computer anxiety—the degree to which students feel anxious while learning about and using a computer (King & Bond, 1996).

These variables are essential to computer achievement. How could an educator help students build up more positive computer attitudes? What factors would influence students' computer attitudes? Liu and Johnson (1998) found that some environmental conditions—such as, computer access, convenient helper, and requirement to use computer on the assignments by other courses—had functional relationships with positive computer attitudes. This study was a continuation of Liu (the author of this paper) and Johnson's 1998 study to investigate the influence of different teaching approaches on student's computer attitudes.

Research Questions and Hypothesis

The purpose of this study was to investigate whether using different teaching methods—instructive method or constructive method—would influence students' computer attitudes on the four attitude variables: enjoyment, motivation, importance, and freedom from anxiety. The research questions examined in this study were:

1. Are students' computer attitudes on the variable "*enjoyment*" different between those who are taught computer technologies with constructive method and those with instructive method?
2. Are students' computer attitudes on the variable "*motivation*" different between those who are taught computer technologies with constructive method and those with instructive method?
3. Are students' computer attitudes on the variable "*importance*" different between those who are taught computer technologies with constructive method and those with instructive method?
4. Are students' computer attitudes on the variable "*freedom from anxiety*" different between those who are taught computer technologies with constructive method and those with instructive method?

It was hypothesized that the difference would be found in at least one of the four attitude variables.

Methods

Subjects

The subjects of this study were 36 teacher education students enrolled in two sessions of a basic computer technology course in an eastern state university. The subjects' ages ranged from 18 to 37 (the average age was 23.48),

including 10 males and 26 females. Around 90% of them had no previous computer skills, beyond using a word processor.

Instruments

The instrument used in this study was derived from Aiken's (1979) Likert-type questionnaire consisting of 24 statements that measured the four computer attitude variables. The 24 statements were sorted into four categories with six statements in each category. Statements in each category measured on attitude variable wit three positive attitude statements and three negative attitude statements. The answer options for each statement were *Strongly Disagree* (SD), *Disagree* (D), *Undecided* (U), *Agree* (A), or *Strongly Agree* (SA), from which one answer must be chosen. For the positive statements, the score for answer SA was the highest (5 points); for negative statements, the score for answer SD was the highest (5 points). The score for each variable was the sum of the six statements. So, higher scores represented a more positive attitude.

This instrument has been tested and found to be a valid instrument to measure each of the four variables independently (Aiken, 1979).

Research Method

This study was to find the different influence of two teaching methods on students' computer attitudes. Although it was not an experimental design, the sample was two existing groups of students. It was assumed that the two groups of students were from a homogeneous population. This assumption was based on the facts that: (1) they all were undergraduate teacher education students; (2) around 90% of them had no previous computer skills, beyond using a word processor; (3) pretest and posttest were employed, and the results of pretest suggested that there is no differences of students' computer attitudes between the two groups (see the Results session). Therefore, it was assumed that all other conditions were under control and different computer attitudes measured at the end of the course were, at least partially, due to the different teaching methods used in the learning process.

Procedures

The subjects were teacher education students in two sessions of a basic computer skill course. They learned the same technology skills, such as word processor, graphic design, spreadsheet, database, Internet applications, *PowerPoint* presentation, and multimedia authoring program.

In one session, teacher-centered instructive method was employed. In each learning task, first, the instructor introduced related concept and functions of the software package. Second, the instructor demonstrated the software with some application samples, and explained the lab work in details. Third, students worked on computers with step-by-step instruction materials and with the instructor's help.

In the other session, student-centered constructive method was applied. In each learning task, first, the instructor briefly introduced the software package about what it can do, and explained some concept. Second, the students received the learning task—to solve one problem. Third, to solve this problem, students needed to explore most functions of the software. They started from explore the functions, command menu, online samples, and then decide how to solve the problem. Last, they created their applications. The following is an example of the student-centered method with which students constructed the knowledge from their own experience:

Task: Learning Mail Merge function in *MS Word*

Problem: You are a school principal. You have 500 students in your school. You need to send a letter to the 500 parents informing them some policy changes of the school administration. Find out a simple way to print out the 500 letters and mail them to the parents.

Introduction: You can use *MS Word* to solve this problem. You only need type one letter and the parent address list. You will use a tool under the *Tools* menu.

Lab Work: Students explored Mail Merge and Label Merge, and wrote down the steps they worked.

Products: Students printed out five sample letters, and address labels.

Pretest and posttest were employed. The computer attitude questionnaire was given to and answered by the two groups of students at the beginning and the end of that semester.

Data Analysis

According to the design of this study, mixed model repeated measure was the appropriate method for data analysis. A SAS macro MIXRPT (Fernandez, 1997) was used to perform the data analysis and assumption checking. The plots obtained from this macro showed that the assumptions of normality, equal variance, and extreme influential outliers were not violated. The significant level for these analyses was set at $\alpha = 0.05$.

In the data analysis, the two groups to be compared were Group A (teacher-centered instructive method group) and Group B (student-centered constructive method group). The four computer attitude variables—enjoyment, motivation, importance, and freedom from anxiety—were repeatedly measured in each group.

Results

First, the pretest results show no difference of the computer attitudes between the two groups ($F_{1,34} = 0.0246$, $P < 0.45$); no difference among the four computer attitude variables measurements ($F_{3,102} = 2.1375$, $P < 0.39$); and no interactions between the two groups on any of the four variables ($F_{3,102} = 3.0051$, $P < 0.34$). The assumption that the two groups of students were from a homogeneous population was based on these results.

Second, the posttest that was taken at the end of this course appeared to have the evidence that the differences did exist. The results are shown in Table 1.

Tests of Fixed Effects

Source	NDF	DDF	Type I F	Pr > F
GRUP	1	34	0.00	0.9862
ATTI	3	102	11.10	0.0001
GRUP*ATTI	3	102	13.92	0.0001

Table 1. Results of the Repeated measures

From Table 1, first the interaction between the two groups on the four attitude variables should be checked. The term that presents the interaction is GRUP*ATTI. The results show that the interaction is significant ($F_{3,102} = 13.92$, $P < 0.0001$). Since the interaction is significant, we need to check where the differences are. The interaction mean plot produced from the data analysis (will be presented on SITE) and results of the differences of least squares means indicate that:

(1) The difference between Group A (teacher-centered instructive method group) and Group B (student-centered constructive method group) on the computer attitude variable "*freedom from anxiety*" was found to be significant ($t = 3.34$, $p < 0.0012$). The comparison was performed as "compare Group A to Group B," therefore, the positive t value indicates that Group A's mean score is higher than Group B's. If the t value is negative, that means Group A's mean score is lower than group B's.

(2) The difference between the two groups of students on their computer attitude variable "*motivation*" was found to be significant ($t = -3.79$, $p < 0.0003$). This results indicate that Group A's mean score is lower than group B's.

(3) There are no significant differences between the two groups of students on their computer attitude variable "*Enjoyment*" ($t = -0.40$, $p < 0.6868$), nor on their attitude variable "*Importance*" ($t = 0.91$, $p < 0.3651$).

The results of interaction may explain some other values in Table 1. In Table 1, the main effect of Group is not significant ($F_{1,34} = 0.00$, $P < 0.9862$). Since there are differences between the two groups on some of the variables, why are the main effects between the two groups not significant? The explanation is that Group A's mean score is higher than Group B's in the variable "*freedom from anxiety*," but lower in the variable "*motivation*;" then the difference between their main effects must be zoomed down.

Conclusions

In conclusion, the results of the data analysis answered the four research questions. The research hypothesis was tested to be true for this set of data. The findings of this study suggest that:

(1) Using teacher-centered instructive method is helpful in reducing students' computer anxiety, especially for those who just start to learning computer technologies.

(2) Using student-centered constructive method is helpful in increasing students' motivation to learn and use computer technologies.

The two variables—computer anxiety and motivation—have been found, from previous studies, the important variables to students' computer achievements. According to the findings of the current study, one question may be raised: Could we increase student' motivation and reduce their anxiety simultaneously by integrating the two teaching methods into technology courses for our teacher education students?

Further studies could be conducted to investigate multiple strategies for multiple learning styles. An instructive-constructive approach could be examined to determine its influence on computer attitude, or even on computer achievements.

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Comparing Technological And Teacher College Students' Computer Attitudes In Taiwan

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Abstract

This paper investigates computer attitudes of technological and teacher college students in Taiwan and compares student computer attitudes by type of college. The results indicate that these college students have positive attitudes toward computers. They value educational computing highly. Most of them do not report high anxiety using computers nor perceive any difference in computer use between males and females. There was, however, significant difference in students' view of computer use by high- and low-achieving students. Teacher college students perceived greater ability-related difference than technological college students. Chi-square results also reveal that teacher education students had less experience working with computers than technological students. Implications of the findings are discussed in the paper.

In the past two decades, computer and technology products in Taiwan have gained great attention. The advancement of computer parts and programs there have also been internationally recognized. Relatively less known is the application of computer technology in education in Taiwan. In fact, one of the greatest challenges in higher education there has been trying to effectively integrate technology into college teaching and learning. Many educational institutions offer courses in computer technology for college students with the purpose of preparing these students to be productive members in the high-tech society. Experts on education reform in Taiwan also stress the need to enhance prospective teachers' computer literacy and skills. As a result, education students, like students in other colleges, have great access to computers. Many teacher colleges require students to complete at least one course in instructional technology to graduate.

With the increasing availability of computer education and training, it is important to investigate cutting edge college students' attitudes toward computers in Taiwan. The close relationship between attitudes toward computer technology and computer use has been well documented. Prior studies on college students' perceptions of computer technology have found that college students' attitudes changed more positively with respect to using computer in instruction (Brownell, Brownell, & Zirkler, 1993; Huang, Waxman, & Padron, 1995, Liao, 1993).

Although there are a number of research paradigms on the study of college students and computers, these inquiries, however, tend to focus on (a) the use of computers as teaching aids at the post-secondary level (Sammons, 1995; Fox, 1993), (b) the implementation and evaluation of instructional computing programs (Handler, 1993, Park, 1994), and (c) the factors affecting the access and utilization of computers (Awbrey, 1996; Cummings, 1995, 1996; Gradgenett & Harrai, 1994; Oliver, 1994). Research has found that most college students want to use computer technology, but their use has been limited to

fairly narrow applications (Fulton, 1993). Previous research further found significant relationships between computer attitudes and computer achievement (Marcoulides, 1988, Wiggins, 1984). Very little research, however, has compared college students' attitudes toward computers. Therefore, this study focuses on investigating computer attitudes of college students in Taiwan and compares student computer attitudes by type of college. The dimensions of student attitudes being investigated include liking, value, anxiety, beliefs in gender- and ability-related differences in using computers.

The present study attempts to provide a knowledge base of what college students feel and think about computers and whether if there are differences in computer attitudes between students from technological institutes and teacher colleges in Taiwan. The findings of this study may help the integration of computers into the teaching and learning processes for college students. More specifically, the present study addresses the following research questions:

(a) What are college students' attitudes toward computers in the dimensions of anxiety, value, liking, gender- and ability-related differences?

(b) Are there any significant differences between technological students and teacher education students' attitudes toward computers in the five dimensions?

(c) Are there any significant differences between technological students and teacher education students in their demographic and computer background?

Methods

Subjects

The participants in the study were 310 technological college students and 372 teacher college students from the outskirts of a large metropolitan city in northern Taiwan. Both types of colleges offer several computer courses at the undergraduate level. In addition, a computer course has been mandated as a part of degree requirements. Among these college students, 30% were male and 70% were female. Ninety-nine percents of them were between the age of 18 and 25. Nearly 11% of them had used computers for less than three months, 17% of them had used computers for three months to one year, and over 58% of them had used computer(s) for more than two years.

Instruments

In the present study, two instruments: The Computer Attitude Scale (Violata, Marini, & Hunter, 1989) and The Ability Differences in Computer Use (Waxman, Huang, & Padron, 1992) were adapted into one survey that was administered to all the subjects. The Computer Attitude Scale consists of four scales: (a) Liking -- the extent to which students like to use computers; (b) Value -- the extent to which students perceive the value of computers; (c) Anxiety -- the extent to which students have anxiety in using computers; and (d) Sex Differences -- the extent to which students perceive gender-related differences in working with computers. The Ability Differences in Computer Use consists of five items measuring the extent to which students believe in ability-related differences in computer utilization. All the scales are on a 5-point Likert rating with 5 indicating strongly agree and 1 indicating strongly disagree. A section on these students' background characteristics was also included on the final survey. These instruments have been found to be reliable and valid. For this study, the internal consistency reliability coefficients range from .60 to .88 for the five scales for students from technological colleges and from .62 to .89 for students from teacher colleges.

Procedures and Analysis

The survey was administered at the end of the academic year to the college students by experienced researchers. The survey took approximately 30 minutes to complete. These students were told that this questionnaire was not a test and they responded anonymously. Descriptive statistics were used to describe these college students' attitudes toward computers. Multivariate analysis of variance (MANOVA) was used to determine if there was an overall significant difference in student computer attitudes on the five

scales by type of college. When the overall significant difference was found, follow-up analyses of variance (ANOVA) were used to determine where the difference(s) were.

Results

The results indicate that, in general, these college students had positive attitudes toward computers. All responded with a mean value greater than 3.00 in Value and Liking and a mean value lower than 3.00 in Anxiety, Gender-and Ability-Related Difference. These students valued educational computing very highly (M=4.14, SD=0.48). Their rating of liking was also positive (M=3.63, SD=0.54). Most of them had low Anxiety (M=1.59, SD=0.68). A majority of them did not perceive any difference in computer use between males and females (M=2.26, SD=0.75), nor did they perceive remarkable difference between low- and high- achieving students' use of computers (M=2.84, SD=0.80).

The MANOVA result indicate that there was an overall significant difference in computer attitudes between students from technological colleges and students from teacher colleges ($F(5,667)=5.00$, $p<.001$). Follow-up ANOVA results indicate that the significant difference was found in students' view of computer use by high- and low-achieving students ($F=17.37$, $p<.001$). Teacher college students perceived greater ability-related difference than technological college students. There were no significant differences between teacher college and technological college students in their liking and value of computers. Nor were there any significant differences between these two student groups in their computer anxiety or perceptions of sex-related difference. Table 1 displays the ANOVA results.

Table 1. Comparison of Students' Computer Attitudes by Type of College

Scales	Teacher College (n=372)		Technological College (n=310)		ANOVA
	M	SD	M	SD	F
Liking	3.62	0.57	3.64	0.53	0.23
Value	4.16	0.52	4.11	0.41	1.45
Anxiety	1.60	0.65	1.57	0.66	0.22
Sex-related differences	2.26	0.75	2.26	0.76	0.00
Ability-related differences	2.96	0.77	2.71	0.81	17.37***

***$p < .001$.

Chi-square results indicated that there were significant differences between the two student groups in their gender distribution, age, and years of computer experience. There were more male than female students in teacher college student group as compared to technological student group ($p<.01$). There were older students in teacher college than in technological college student group ($p<.05$). In addition, teacher education students had less experience working with computers than technological students ($p<.01$).

Discussion

The findings of the present study support previous research reports that college students in Taiwan generally have positive attitudes toward computers (Huang & Padron, 1997, Liao, 1993). Both technological and teacher college students value computers highly. They think that it was necessary and worthwhile for college students to learn how to use computers. They do not report high anxiety or being uncomfortable working with computers. Nor do they view any significant difference between males and females in computer use. In other word, they do not think that it is more important for male students to use computers than for female students, or that it is more difficulty for female to use computers than for male students.

There is a significant difference between technological and teacher college students' attitudes toward computers in terms of ability-related difference. More teacher education students have greater confidence in high-achieving students than in low-achieving students in computer use. Although these college students do not view ability as an issue in terms of students being able to learn and enjoy computer applications, more teacher education than technological college students perceive that (a) working with computers is more difficulty for lower-achieving students than for higher achieving students, (b) using computer is more enjoyable and more important for higher-achieving students than lower-achieving students, and (c) lower-achieving students can not do as well as higher-achieving students in learning about computers. This discrepancy may be partially due to the stereotype of teacher college students. They tend to over emphasize the relationship between ability level and academic achievement of students. It may be partially due to the fact that they had less computer experience than technological students, and therefore had less confidence in believing that all students can learn computer well. Further research needs to identify factors that may explain this difference and design strategies to overcome the ability-related bias of teacher education students.

The findings of the present study have several educational implications. First, the findings provide insight into understanding college students' computer attitudes and how students from various colleges may differ in their perceptions of computer use. Higher education institutions may thus design more effective curriculum to bring about desirable changes for their students. For example, Stephen & Ryan (1992) suggested how institutions may increase the knowledge and use of technology for college of education students. Second, the study identifies differences in college students' demographic and computer background variables, and allows future research on exploring the relationship between these variables and students' computer attitudes to verify findings of previous research studies (Huang & Padron, 1997). Third, this study can serve as a basis for comparing computer technology attitudes among college students across different institutions and cultures.

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Mining for Knowledge about Technology Training

by

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Introduction

This paper concentrates on an evaluation of the NSF/NLU Teacher Enhancement program (TEP). The TEP, a three-year project sponsored by the National Science Foundation (NSF), allowed the Department of Computer Science to bring to Northeast Louisiana University sixty (60) teachers from the surrounding fifteen (15) parish area and train them in compter related technologies that could be integrated into their classrooms. The participants of the program were introduced to technologies such as multimedia, the World Wide Web (WWW), and electronic mail (e-mail). They were also instilled with the confidence to become technology trainers for their districts. The focus of the evaluation is centered around the success of the participants in their role as technology trainers for their districts.

Survey Instrument

In order to assess the success of the TEP, the Teachers' Attitude Toward Information Technology (TAT) version 1.1 survey instrument was distributed to the faculty of two local school systems. The TAT, which is composed of ten separate indices, was developed and verified by the Texas Center for Educational Technology (TCET) which operates under the auspices of the University of North Texas (Christensen and Knezek, 1998). Eight of these indices were constructed using Zaichkowsky's (1985) Modified Personal Involvement Inventory, which is a context free sixteen item semantic differential scale that focuses on "a person's perceived relevance of the object based on inherent needs, values, and interests." The other two areas of the TAT utilize Kay's semantic perception of computers (Kay, 1993) and D'Souza's (1992) classroom learning via electronic mail.

The Survey

The research project surveyed teachers from the Ouachita Parish School System (OPSS) and the Monroe City School System (MCSS). These systems were chosen because of their system-wide commitment to technology. Approximately four hundred (400) questionnaires were distributed to the faculty of these systems. Of these one-hundred and sixty-nine (169) were returned for a return rate of 42 percent. The gender dichotomy represented 36 males and 133 females.

The survey sample consisted of various levels of experience and types of training received. The more seasoned teacher represented 44 percent of the respondents; whereas, the lesser experienced teachers represented 21 percent. Teachers from the MCSS represented 59 percent of the respondents and OPSS represented 41 percent, respectively. Four of the teachers did not respond to the question pertaining to teaching experience. The TEP trained respondents represented 62 percent of the sample and were fairly balanced between the two systems. Fifty-two percent of the TEP trained teachers were employed by MCSS and 48 percent of the TEP trained teachers were employed by OPSS. Of the 65 respondents in the Non-TEP group, 72 percent were from MCSS and 28 percent from OPSS.

Of the one hundred sixty-nine questionnaires, thirty-eight of the respondents omitted one or more of the subscales leaving one hundred thirty-one completed questionnaires. The two systems were adequately represented in both gender, level, and training received. The data collected exhibited an internal consistency reliability, Cronbach's Alpha, comparable to the literature (Cronbach, Gleser, Nanda, Rajaratnam, 1972). The TAT reliability estimates for K-12 teachers from the Ouachita Parish School and Monroe City School systems ranged between 0.88 and 0.90.

Research Hypotheses

The research hypotheses of interest are multifaceted and consist of comparing the attitudes toward technology by school system and method of training. Of interest in this study is the evaluation of the success of the NSF/NLU TEP program. As mentioned previously, a major component of the TEP was to develop technology trainers for the school districts. The TEP trained technology instructors were used by their districts to provide training for their colleagues. To measure or assess the success of the TEP in this endeavor, the attitudinal responses toward technology of the faculty from the two systems were collected via the TAT. The effects of the TEP are examined by arranging the data into one of four groups. These groups are summarized in Table 1.

Table 1
Experimental Groups

Experimental Groups	Explanation
Group 1	TEP Trained Teachers from MCSS
Group 2	Non-TEP Trained Teachers from MCSS
Group 3	TEP Trained Teachers from OPSS
Group 4	Non-TEP Trained Teachers from OPSS

The arrangement of the data into one of the four groups represent a one-way classification or a completely randomized design. This design was selected over a factorial model due to the inconsistencies in the Non-TEP groups between the two systems. Some of the faculty in the Non-TEP group from MCSS were trained by the university faculty who later served as the staff of the TEP. This pre-TEP training was sponsored by MCSS through state supported technology grants. The success of this program provided the foundation upon which the TEP project was developed. This additional training of teachers by the TEP staff was not the case for the teachers in the OPSS Non-TEP trained group. Under these assumptions, then, the research hypotheses of interest are:

Hypothesis 1: Teachers who have received training from the participants of the NSF/NLU TEP program have a more positive appreciation of what technology can do for their students and for themselves when compared to the teachers who have received training from other sources.

Hypothesis 2: Regardless of where they received technology training, teachers from the Monroe City School system have a more positive attitude about technology than the teachers from the Ouachita Parish School system due to the long-term MCSS commitment to training

Latent Variables

According to DeVellis (1991), what is of interest in a survey, composed of scale items such as the TAT, is the underlying phenomenon or construct reflected by the scale items. These underlying phenomena are usually referred to as latent variables and are related to the scale items that are inadvertently measuring the phenomena. One theoretical model that has been successfully used to describe this relationship is the general factor model. The general factor model allows multiple latent variables to serve as causes of variation in a set of scale items. Factor analysis, thus, is a beneficial procedure that can indicate the important properties of a scale. The primary functions of this analytical procedure are threefold. First, factor analysis will assist in determining how many latent variables are underlying the set of scale items. Secondly, factor analysis provides a means of explaining variation among original variables using relatively few newly created variables. Lastly, factor analysis aids in defining the meaning of the factors or latent variables by estimating the loadings which each scale item has with the newly created latent variables.

With this research data, factor analysis indicated that two significant factors or latent variables are present. DeVellis (1991) states that factors are defined by the items that load most heavily on it, that is, those loadings which are greater than 0.50. Thus, Factor-1 is heavily loaded with the TAT subscales of F3, F4, F5, F6, F7, F8, and F10. F10 relates to the teacher perception about computers; whereas, the other items address attitudinal responses of the teachers on the different components of the technology issue. Factor-2, on the other hand, relates to F1, F2 and F9,

which measures attitudinal responses of the teachers' perception of the benefits of e-mail for their students, to themselves, and for their classrooms. Thus, Factor-1 is a general technology appreciation factor; whereas, Factor-2 is an e-mail appreciation factor. The two latent variables derived from this survey data are mathematically defined as follows:

$$\text{Factor-1} = 0.81469*F3 + 0.80566*F4 + 0.81413*F5 + 0.76876*F6 + 0.77667*F7 + 0.66822*F8 + 0.69933*F10$$

$$\text{Factor-2} = 0.66678*F1 + 0.81555*F2 + 0.88759*F9$$

Prior to analysis, the survey data was re-coded using the two latent variables. The newly generated data and the ten NIT subscale scores were analyzed by the ANOVA procedure.

Latent Variable Analysis

When considering the technology appreciation factor (Factor-1), the analysis of these data indicates that attitudinal differences are present among the four groups ($F = 4.6202$, p-value = 0.0041). The average technology appreciation values are 33.57, 33.05, 32.50 and 28.28, respectively for the samples representing the MCSS: TEP trained, MCSS: Non-TEP trained, OPSS: TEP trained, and OPSS: Non-TEP trained groups. Ancillary analysis further indicates that the teachers in this study who represent the Monroe City School system have a more positive appreciation ($t = 3.2518$, p-value = 0.0015) for technology than the teachers representing the Ouachita Parish Schools. The post-ANOVA analysis indicates mixed conclusions about the effect of training. In the Monroe City School system, the analysis of attitudinal differences between TEP trained versus Non-TEP trained teachers is inconclusive ($t = 0.5014$, p-value = 0.6169). However, within the Ouachita Parish School system the teachers representing the TEP trained group have a more positive appreciation for technology ($t =2.8636$, p-value = 0.0049) than the teachers representing the Non-TEP trained group.

The analysis of the E-Mail factor (Factor-2) also indicates that attitudinal differences among the four groups prevail ($F = 2.7585$, p-value = 0.0447). The average E-Mail appreciation values are 10.96, 11.24, 10.01 and 9.78, respectively for the samples representing the MCSS: TEP trained, MCSS: Non-TEP trained, OPSS: TEP trained, and OPSS: Non-TEP trained groups. The post-ANOVA linear contrasts further indicate that an attitudinal difference was noted between the two systems. The teachers representing the Monroe City Schools have a more positive appreciation for what E-Mail can do for themselves and their students than the teachers representing the Ouachita Parish Schools ($t =2.69998$, p-value=0.0079). The statistical tests comparing training techniques within each of the systems proved to be inconclusive. Thus, one can conclude that differences in the E-Mail appreciation factor only existed at the school system level and is not dependent on the training that the teachers received.

In summary, the analysis indicated that teachers from the Monroe City School system have similar attitudes toward technology and e-mail as a tool for themselves and their students regardless of type of training. However, this was not the case for the teachers representing the Ouachita Parish Schools. The teachers from OPSS who received training from the TEP participants have a more positive appreciation for what technology (Factor-1) can do for them and their students when compared to the teachers from OPSS who were trained by other sources. Additionally, the teachers from the Monroe City School system have a more positive appreciation for what technology and the e-mail can do for their students and for themselves than the teachers from the Ouachita Parish School system. This latter conclusion may be refective of the long-term training commitment made by MCSS.

NIT Subclass Analysis

As with the latent variable analysis, the ten NIT subclasses F1-F10 were analyzed. The analysis consisted of pooling the secondary school, middle school and elementary school data into one of the four experimental groups representing the two systems and the two training methods. The analysis of this multivariate data indicated that differences in preference patterns among the four groups are present (Wilks' Lambda = 0.686418, p-value = 0.0294). To delineate the differences, subsequent subsections will focus on each of the NIT subclasses grouped according to the subclass categories relating to the "To me..." and "For my student,..." questions.

Subclass Analysis: "To me,..."

The NIT subclasses referencing the teacher's attitudes toward technology focuses on the e-mail (F1), multimedia (F3), productivity (F5), the WWW (F7), e-mail in the classroom (F9), and computers in general (F10). Table 2 describes the F-tests and their associated p-values for testing the null hypotheses of no differences among the group means for each of the NIT subclasses. As can be seen from this table, all six F-tests rejected the null hypothesis at the 0.05 level of significance.

Table 2
NIT Subclasses: F1, F3, F5, F7, F9, and F10

Source of Variation	DF	F1	F3	F5	F7	F9	F10
Groups	3	F=6.8709 p=0.0002	F=5.6331 p=0.0011	F=5.2727 p=0.0017	F=5.7888 p=0.0009	F=3.5376 p=0.0162	F=4.6232 p=0.0039

Thus, for the four groups under study, the teachers' attitudes comprising these groups are different. Table 3 summarizes the results of the linear contrasts used to delineate differences between systems and training. In this table Contrast-1 compares MCSS vs. OPSS regardless of training, Contrast-2 compares TEP Trained vs. Non-TEP Trained in MCSS, and Contrast-3 compares TEP Trained vs. Non-TEP Trained in OPSS. Contrast-1 indicates that the teachers' attitudes between the two systems are different for each of the six NIT subclasses. The significant t-tests indicate that the teachers representing the Monroe City School system have a more positive attitude toward technology than the teachers representing the Ouachita Parish School system. Furthermore, from this table it is also seen that training source had no effect on the teachers' attitudes toward technology when considering the teachers from the Monroe City School system. Contrast-2 was not significant for each of the six NIT subclasses. However, this was not the case with the Ouachita Parish School system. Contrast-3 indicates that differences were observed in the subclasses of multimedia, productivity, and computers in general and that the TEP Trained teachers in OPSS did have a more positive attitude about these NIT subclasses than their counterparts in the survey who represented the Non-TEP Trained group.

Table 3
Linear Contrasts
t-values and associate p-values

Contrast	F1	F3	F5	F7	F9	F10
Contrast-1	t = 4.2764 p = 0.00003	t = 3.9079 p = 0.0001	t = 3.3896 p = 0.0009	t = 3.9917 p = 0.0001	t = 2.7698 p = 0.0065	t = 3.321 p = 0.0011
Contrast-2	t = -0.697 p = 0.4867	t = -0.19 p = 0.3775	t = 0.05 p = 0.8043	t = 0.18 p = 0.816	t = -1.576 p = 0.117	t = 1.3422 p = 0.1814
Contrast-3	t = 0.2881 p = 0.7737	t = 2.5135 p = 0.0139	t = 3.167 p = 0.0018	t = 1.8757 p = 0.0626	t = 0.1244 p = 0.9011	t = 2.0265 p = 0.0444

NIT Subclass Analysis: "For my students..."

The NIT subclasses referencing the student's attitudes toward technology as assessed by their teachers focuses on the four categories of e-mail (F2), multimedia (F4), productivity (F6), and the WWW (F8). Table 4 descibes the F-tests and their associated p-values for testing the null hypothesis of no differences in student attitudes

Table 4
NIT Subclasses: F2 F4, F6, and F8
Teachers' Perception About Their Students' Attitudes

Source of Variation	DF	F2	F4	F6	F8
Groups	3	F=0.3273 p=0.8057	F=2.4302 p=0.0677	F=2.1756 p=0.0933	F=1.5759 p=0.1980

among the groups. As can be seen from this table, all four F-tests were inconclusive at the 0.05 level of significance, but with a relaxed significance level of 0.10, two of the subclasses were significant. Table 5 summaries the three linear contrasts which compares the two systems and the two training sources within systems. As can be seen from this table, the TEP-Trained teachers in OPSS do exhibit a more positive perception about the impacts of multimedia on their students and felt that their students would be more productive when compared to their counterparts. This table also indicates that the teachers from MCSS have a more positive perception about their students' attitudes for the NIT subclasses of multimedia and productivity than the teachers from OPSS.

Table 5
Linear Contrasts
t-values and associate p-values

Contrast	F2	F4	F6	F8
Contrast-1	t = 0.7783 p = 0.4377	t = 2.3704 p = 0.0191	t = 1.7032 p = 0.0906	t = 1.4603 p = 0.1465
Contrast-2	t = 0.0259 p = 0.9793	t = 0.1611 p = 0.8722	t = 0.9163 p = 0.3610	t = 0.5839 p = 0.5602
Contrast-3	t = 0.1870 p = 0.8517	t = 2.1364 p = 0.0344	t = 2.1570 p = 0.0326	t = 1.9362 p = 0.0549

NIT Subclasses: Summary

The analysis of the NIT subclass data was fairly consistent, regardless of the subclass. When considering the impacts on computer technology as it relates to the teacher, it was seen from the above analysis that teachers representing the Monroe City School system have a more positive appreciation for the different facets of technology than the teachers representing the Ouachita Parish School system. Furthermore, when viewing the impacts of training, attitudes were affected only in the Ouachita Parish School system. TEP trained teachers in OPSS have a more positive attitude about technology than the Non-TEP trained group. These latter differences were present in the NIT subclasses of multimedia, productivity, the WWW, and general feelings about the computer. When considering the impacts of computer technology as it relates to their students, the teachers had positive feelings about the impacts, but at the 0.05 significance level none were significant differently from the others. These non-significant findings were consistently observed between the two systems and the two training sources.

Conclusions

The survey indicates that MCSS teachers do have a more positive attitude about technology than their colleagues in OPSS. The attitudinal differences are consistently observed regardless of the analysis approach. Differences between the systems were noted for the two latent variables as well as the NIT subclasses. The latent variable approach gave a collaborative overview of the differences between the two systems; whereas, the NIT subclass analysis focused on area specific differences. The two appoaches jointly reinforce each other in their conclusions about system differences.

The success of TEP, as measured by observed differences in teacher attitudes between the two training groups, is accentuated in the OPSS system. TEP trained teachers in this system do have a more positive attitude about technology than their Non-TEP trained counterparts. This attitudinal shift is observed for the NIT subclasses of multimedia, productivity, the WWW, computers in general, and the latent variable Factor-1. The lack of discernible effects for the e-mail categories indicates that the training received did not affect attitudes about e-mail.

The lack of significance within the Monroe City School system is more related to the type of training that the teachers received in the Non-TEP group and to the long-term commitment that MCSS has made to training. Thus, the non-significant training effects observed in MCSS may be interpreted as an effect which measures the effectiveness of the TEP. That is, the training of teachers by the TEP participants is as good as the training of teachers by the university faculty who latter became the staff of the TEP. The effectiveness of the TEP to produce good trainers along with the successes observed in OPSS jointly reinforce the conclusion that the NSF/NLU Teacher Enhancement Program was an effective program that can serve as a model for others to follow.

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Teaching Teachers About Research: A Computer Expert System for Statistical Procedure Selection

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This expert system is designed to help in the selection of the applicable statistical procedure for use with any given research problem. It is based on the following research problem attributes: a) the number of variables involved; b) the number of measures per variable; c) the type of theoretical/statistical model (*randomization, data reduction/classification, distribution, difference, or correlation*) at hand; d) the specific scales of measurement (*nominal, ordinal, interval, ratio*) involved; the sample's size; and f) the normality of the distribution of the data. The system has been used successfully to enable teachers in introductory research courses, as well as more experienced researchers, to quickly and accurately select the applicable statistical procedure for any given research problem by thinking of the problem in terms of these key attributes. A computer program can be obtained free of charge by submitting a 3 1/2" IBM disk to the senior author.

Incidental Learning in a Higher Education Asynchronous Online Distance Education Course

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Abstract: The purpose of this study was to examine and describe the incidental learning activity of students in an asynchronous online course in a higher education setting. This research was conducted with data collected from interviews, journals, observations, email messages, and online conferencing software postings of 22 members of three sections of a graduate-level asynchronous online distance education course at Northwestern State University of Louisiana in the spring of 1998. Two types of incidental learning outcomes were observed. The first developed from the students' use of the technology itself. The second centered on an improvement in certain areas of the students' personal development. An increase in time management ability, self-directive behavior, self-confidence, and self-discipline occurred. The results of the study illustrate the value of incidental learning in an asynchronous online course and the need for coursework development that fosters the growth of incidental learning.

Introduction

The information and resources offered on the Internet, or the World Wide Web, are becoming a normal part of the academic lives of students in institutions of higher education throughout the United States and the world. Statistics about the Web and its users are changing daily, and the numbers are increasing rapidly. The Web provides a vital link to information and research. Colleges and universities have discovered that learning does not have to be confined to the four walls of a traditional classroom, and institutions of higher learning are harnessing these resources to reach their students and provide crucial, timely, and in-depth material, often through the method of distance education. Higher education faculty and administrators need to look at what students are learning in their online distance education courses in order to design effective online courses. A statistical analysis completed by the National Center for Education Statistics (NCES) in 1997 shows that a third of higher education institutions offered distance education courses in the fall of 1995 and another third planned to offer such courses in the next three years. Computer technology is becoming an important element for distance learning. It provides a powerful way to communicate, search for and retrieve educational resources both locally and globally, network using media such as the Internet, and access collaborative learning environments (Franklin, Yoakam, & Warren, 1996). Institutions of higher education are discovering that courses conducted online through this electronic medium benefit both the institutions and their students.

Incidental Learning Research

Research beginning as early as 1928 showed no significant difference in the comparative impact of technologies on the students' primary learning (Russell, 1997). This primary learning is the learning that is obtained by students from the formal curriculum of a particular course. However, unintended or unanticipated learning does occur in these technologically diverse settings (Mealman, 1993). The general literature concerning incidental learning describes student learning outcomes that have not been part of the planned curriculum (Apps, 1978; Brookfield, 1986). It is suggested that the unintended consequences of a learning situation are often more important to the learner than the original objectives (Jones, 1982).

Not all incidental learning is positive or desirable. Ragsdale (1997) discusses what he terms "unanticipated outcomes" when technology is integrated into the classroom setting. When students are left

alone while they use technology, teachers tend to overestimate the computer skills of the students. He found that students tended to skip from one task to another and had difficulty completing their tasks.

Several researchers have focused on informal learning as it relates to the adult learner. Withnall (1990) identifies definitions and types of informal learning and examines issues such as the utility of informally learning the processes involved, and the lack of methods to assess the quality of learning acquired informally. Lankard (1995) addresses some of the new ways adults learn at work, including action learning, situated learning, and incidental learning. She writes that incidental learning is unintentional and unexamined. It is not based on reflection; thus the learning is embedded in the learner's actions. The difficulty in validating incidental learning as an effective learning strategy is that learning is not anticipated; therefore, it is not easily assessed. The primary intent of the activity is to accomplish the task, not to learn. When incidental learning occurs, it is a byproduct of other activity. The learner discovers something while in the process of doing something else. The learner must pull away from the primary or planned task and examine the discovery clearly before he can learn from it.

One case study of incidental learning by adults in a nontraditional degree program appears to be the most definitive (Mealman, 1993). The study looked at the nature of students' incidental learning and specified the role that incidental learning played in the student experience in the nontraditional adult degree program. Mealman found that students did not make distinctions between incidental and intentional or formal learning. He also found that incidental and intentional learning played equally important roles in the students' overall experience.

Purpose and Research Questions

Because of the need for understanding the experiences of students concerning incidental learning in asynchronous online distance education courses, the researcher of this study looked for answers to two questions: "What incidental learning occurs in a particular graduate level asynchronous online distance education course?" and "What is the nature of the students' incidental learning?" The purpose of the study was to examine and describe the incidental learning activity of students in an asynchronous online class in a higher education setting. This study was based on a deliberate research method with the following characteristics: dialogue with graduate students, direct observation of online activity, email summaries, posted class materials, and semester-length student journals.

The researcher considered questions involving the nature of the students' incidental learning, the characteristics of the individual participants in the electronic online course, the students' degree programs, and the amount of time the students invested in the course. She also observed the frequency of conference postings by the students, the motivation of the students to participate in this particular type of educational course, the nature of the students' enthusiasm for the use of current technology for educational purposes, and the changes that participants perceived in themselves as a result of participation in this electronic online course.

Methodology and Data Collection

A qualitative methodology was used to collect data from students in the three sections of a graduate level distance education online course during the spring, 1998, semester. The study consisted of an individual initial interview with each participant, an individual exit interview with each participant, and a late-semester email checkup with the participants. The researcher monitored all conference postings and email messages to the instructors and to individual students and conducted several observations of students as they posted material to the conferencing software. The researcher analyzed a small collection of journals kept throughout the semester by a few of the participants and investigated the official grade books and grade sheets used by the instructors of the two groups.

The physical locations of the participants varied widely. Some were on the local university campus; many were near the main campus of the University in Natchitoches, Louisiana, or the surrounding small communities; a large group was in the middle schools of Bossier Parish, Louisiana; some were in other parts of Louisiana; and several were in other states. None were outside of the United States.

The researcher conducted two standardized open-ended interviews with each of the participants. The interview at the beginning of the semester was designed to determine the current technology learning level of

the participant, to delineate participant experiences with online courses, and to elicit participant beliefs concerning necessary skills, time involvement and anticipated learning in this particular online course. Twenty-two initial interviews were conducted. The interview with each of the participants at the end of the semester was designed to determine the participant's unanticipated or unexpected learning outcomes. The researcher conducted twenty-one exit interviews. The researcher analyzed student journal entries for student insights. The participants could choose not to allow the researcher to use the journal to acquire data. Instead, the participants could use the journal solely for their own personal reflection. In this case, the researcher was able to access some of this information in the end-of-semester interviews with each participant. Nine participants kept journals throughout the course, and four participants gave their journals to the researcher at the end of the semester. The researcher asked the participants to include electronic mail communications received throughout the semester in their journal entries so the researcher could access and analyze this data. The researcher traveled to the physical location of eight participants to observe behavior in composing and posting messages to the conferencing software, TopClass and WebBoard. The researcher observed the participant's interaction with the technology, methods of posting, and collected field notes in a descriptive form. She read, organized, and analyzed all written online conference postings to document the learning that was taking place during the course. The researcher acquired all email messages received by the instructors of all sections of the course and all email messages posted through the conferencing software. She recorded her own personal experiences throughout the study to use as a reflection of the field experience. The researcher acquired responses from an informal open-ended questionnaire conducted via email at the mid-semester point of the study. Triangulated information was gathered from participants by use of official documented data, interviews, email surveys, observations, and journals.

The researcher observed and analyzed the written material posted online by each of the students in the course, formally interviewed the participants in both sections of the class at the beginning and end of the respective semesters, observed participants as they prepared and posted online material for the course, compiled answers to a mid-semester email questionnaire sent to participants, and collected and analyzed data from journals that participants kept throughout the semester. The data from all interviews, observations, journals, and conference postings were compiled and analyzed by the researcher to determine the amount, type, and effect of incidental learning that occurred throughout the course.

The Conferencing Software

To be able to participate in an online class, students need more than just computers and phone lines. Some type of software that facilitates sharing and communicating of information is required. This study deals with World Wide Web software for text-based, asynchronous group discussions. It is not concerned with real-time (synchronous) chat, video, or audio conferencing, although all of those are excellent means for students and instructors to communicate over a physical distance.

Two sections of the course used TopClass (TopClass, 1997), a system for developing and delivering Web-based training, including discussion forums. Its developer is WBT Systems and it runs on UNIX, Windows, and Macintosh systems. This software was put on a server under the direction of the Northwestern State University's Academic Computing Office (TopClass at NSU, 1998). Eight other online courses were using this software for the spring of 1998 semester. It reveals its inner workings in the form of database contents which can be accessed through a Web browser which is exactly what the I1N an 01N students did. Each student, regardles of physical location, could log onto the conference through an Internet browser. TopClass is password protected and only members of the class had access to the information it holds.

The third section of the course used an older package called WebBoard (WebBoard, 1996). Its developer is Duke Engineering and is marketed by O'Reilly Software. It runs on Windows NT and 95 platforms. WebBoard was loaded on the College of Education Educational Technology server and ran through its Learn Net website (Learn Net, 1998). WebBoard is software for intranet- or Internet-connected Windows 95 or NT computers that allow Web site visitors (in this study, students in the ETEC 5710 course) to interact via threaded discussion forums and/or real-time chat, using regular Web browsers such as Internet Explorer or Netscape.

Findings and Conclusions

To reach the desired goal of discovering what incidental learning occurred in this course, the researcher asked questions and watched for behavior that addressed multiple issues both at the beginning of the course and the end of the semester. At the beginning, issues included reasons for taking the course, first thoughts and initial expectations of the course, the skills the student felt were necessary to complete the course, and the possible differences between skills needed for an online course and a traditional course. Other early-in-the-semester issues were time expectations, specific learning outcomes the student wanted to acquire in the course, and the students' main concern about the course. At the end of the course, issues of importance to the students had been modified. Topics of discussion and concern included self-ranking for success, skills that helped the student achieve success, the main skill learned or gained during the semester, and skills that differed from the traditional courses. The researcher also asked questions concerning the type of "poster" each student was when working with the conferencing software. Students listed not what they wanted to learn but what they felt they had learned in the class. They also compared their initial thoughts and expectations of the course with what they actually encountered throughout the semester. Students were asked whether the course took more or less time than they expected and to describe their workplace. The thoughts of the students towards future online course work for themselves and towards the future of online learning in general were gathered.

The researcher found that two types of incidental learning occurred. The first developed from the students' learning to use the technology itself. Accessing the Internet, learning to develop Internet search skills, working within an online course, and using the conferencing software fit in both the primary and incidental learning categories. While part of these activities can be classified as primary learning, the manuevering and mechanical operation of the technology was not the prime objective of the course. Students learned how to conquer the conferencing software, how to post, how to use search engines and how to phrase words for a search frequently. Some learned the effective and proper use of bookmarking when working within the Internet environment. Others mastered word processing skills. Students learned how to cut and paste from one document to another, to save work frequently, and to use the spellchecker. This learning occurred as the student worked to acquire the primary learning to meet the goals and objectives of the course.

The researcher defines incidental learning as unplanned and unanticipated learning outcomes not identified as part of the formal curriculum that students obtain while participating in the class. If the strict definition is followed the outcomes in this first group of learning outcomes can be classified as incidental learning. The course is basically concerned with learning how to integrate technology into the classroom, not with learning how to master the technology.

Other learning outcomes more easily and obviously fit into the incidental learning classification. Students learned to learn in an isolated situation and learned more patience. Other personal skills were acquired by students. Students learned to procrastinate less; they grew in self-confidence and self-worth. An increase in self-discipline is mentioned frequently. The ability to adapt to non-traditional learning environments is an important learning outcome. Other task-oriented skills were learned that were not required by the syllabus for successful completion of the course. One student taught himself to use an authoring program because he felt it should be included in the syllabus, but it was not.

The researcher found that the strengthening of self-discipline and self-confidence was a direct result of these teachers taking and being successful in an online course. The value of being successful in a graduate level online course was stressed by several experienced teachers. They are often looking for something new and interesting. Online course work interested them and provided a challenge that could be achieved. Students in the online course exhibited an increase in self-knowledge, the development of self-confidence, and the belief that more new goals can be set and successfully accomplished. Their technological skills and understanding of their present and future world increased.

The issue of time management was important. Students frequently discussed personal growth in this area as the semester concluded. While they found the process stressful at times, the improvements made in the more appropriate management of time were a positive force.

The researcher supports Mealman's (1993) assertion that students do not differentiate between incidental and intentional learning. Students do not make distinctions that would support the categorizing of learning outcomes into primary and incidental by the instructor or the institution. The two types of learning outcomes play equally important roles in the students' overall experience.

Eight research questions guided the examination of learning in this asynchronous course. The responses to these questions were addressed as related to the findings of the study. The nature of the incidental learning has been previously reported. Novices rated themselves lower in terms of success than did experienced computer and Internet users. More novices failed to complete the course in the specified time allotted and had

to finish the coursework after an "incomplete" was given, but all did complete the course.Incidental learning outcomes were apparent for participants who were taking the ETEC 5710 course to foster their knowledge about technology, participants who were completing master's and specialist's degrees, and those who were obtaining additional certification or hours towards their master's plus thirty classification. The degree program of the student appeared to make no impact on the amount or type of incidental learning acquired by the participant.

Students were evenly divided over the issue of actual time needed versus time they expected to need for successful completion of the course. Each group was proportionately divided between novices and experienced computer and Internet users. The researcher found no relationship between the amount of time expected or the amount of time taken by the participants and the amount and type of incidental learning that occurred within the course during the semester. The researcher found no evidence of a relationship between the frequency of conferencing postings and the amount and type of incidental learning acquired.

Finding a connection between motivation to participate in this online course and incidental learning proved difficult. Basically, all the students did well and acquired significant primary and incidental learning outcomes. All students were motivated by something; some were following a degree plan, some were impressed by the idea that they did not have to drive to the main campus, some were pleased the course tuition was being paid for through a grant, some just like to learn new material. The researcher found that motivating education graduate students was usually not a problem. Students who enrolled in this course were motivated, and they all learned. Some had problems with time allocation and some had mechanical/technical problems, but all persevered and completed the course satisfactorily. The researcher found that those who were motivated by an enthusiasm to learn more about technology ranked themselves as more successful in the course. They were able to circumvent the inevitable crises that technology often creates during the semester. Many of these participants expressed a strong increase in self-confidence upon completion of the course.

Participants reported an increased ability to manage time, a belief that more online coursework was possible and probable, a higher level of self-confidence and patience, and more effective self-discipline. Research, writing, and word processing skills improved. The students' ability to use the Internet for online course work and researching improved. The few who did not rate themselves as successful learned more about their own learning styles and personality traits. Several said that a different type of online course might be more effective in acquiring primary and incidental learning outcomes.

Discussion and Significance of the Study

When this study began, I expected to find multiple examples of incidental learning occurring among all students in the graduate online class including development of Internet search skills, improvement of typing skills, and strengthening of research skills. I expected that these unintended consequences of a learning situtation would be at least as important to the learner as the original objectives specified in the course syllabus. These expectations proved to be true, but I also learned that incidental learning is a complex issue, and its effects were important to the overall learning outcomes which were occurring within the course. An additional, unforseen set of unexpected learning outcomes surfaced. Incidental learning affected the development and strengthening of several major personal attributes of many of the students. Students repeatedly reported an improvement in self-confidence and self-determination. Students who were at first intimidated by the prospect of a technology-based, online graduate-level class were amazed and thrilled that they had not only survived but usually had flourished. Many were fueled by a basic desire to learn something new. When they accomplished this goal, they felt good about themselves and continued to learn more about integration of technology into the classroom. Students who began with basic technology skills and an expectation to succeed did well and accomplished their goals. Students reported improvements in time management and organizational skills. I saw and heard excitement and enthusiasm in the voices, writings, and actions of adults. Such motivation is rare in a traditional classroom setting. This acquisition of enthusiasm through the attainment of learning outcomes fostered by incidental learning may be a key to successful lifelong learning for our educators. Perhaps the availability of online courses for educators may be a way to keep excitement in learning for all students.

The results of the study will be used to gain a more comprehensive understanding of the learning that occurs in a university-level graduate online course, to identify such experiences, and to related them to activities occurring within the framework of a particular course. The significance of this study goes beyond a particular online course. The data gathered, analyzed, and summarized in this study can be used to better understand the nature of online learning in general. Understanding the nature of the learning that is occurring in online courses

will allow higher education faculty and administrators to design courses and programs that produce higher student learning outcomes.

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Historical and Current Attitudes Toward and Uses of Educational Technology

Chapter Two

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Abstract: This is a final report on research conducted to determine the attitudes, beliefs, and preparation of in-service teachers, pre-service teachers, and student teachers regarding the uses and integration of technology into the classroom and curriculum. Data was collected in Elementary, Middle and High Schools in several school districts and at St. Mary's University in San Antonio, Texas. The results were compared with data gathered over seven years from pre-service teachers in the teacher certification program at the university and with research regarding national trends. The question was, "Are teachers feeling comfortable and confident in implementing and integrating the uses of technology in everyday classrooms?"

Background

The Council on Basic Education (1998) has said "(t)o be effective, technology certification for educators needs to be part of formal education policy and a required element of school and teacher evaluations. ...Educators need a system of technology training and certification." Research has found that teacher skill in using technology is a major factor in improving student learning with technology. Teachers must know not only *how* to use technology but also *when* and *why* to use it (Burke, 1998). Because of a national mandate by President Clinton in 1996 that every young person must be technologically literate by the 21st century, Texas adopted standards to assure the development of technologically literate individuals possessing the knowledge and the skills to solve problems, make decisions, and be lifelong learners in a society increasingly dependent on rapidly changing technologies. The Texas Essential Knowledge and Skills (TEKS) curriculum components adopted by the State Board of Education in 1997 consist of basic understandings, knowledge and skills, and performance objectives required of K-12 students. For the first time, standards had large sections devoted to technology of all types for all grade levels. Teachers are expected to integrate the TEKS into the curriculum during the current school year and will be held accountable for student performance on the Texas Assessment of Academic Skills (TAAS) to evaluate student achievement and qualify students for graduation from high school. According to the latest publication by Southern Regional Education Board (1998), Texas has adopted proficiencies to "plan, implement and assess instruction using technology and other resources" through adoption of The Learner-Centered Proficiencies for Teachers. The application of the standards means that the Texas State Board for Educator Certification with the Texas Education Agency is developing technology proficiency requirements for use in teacher licensing. Universities with teacher certification programs are watching this development carefully and working to stay abreast of the changes in licensure with changes in the program requirements for inservice teachers.

To meet the demands of both the Presidential mandate and the Texas Education Agency, teachers must be trained and be comfortable with the uses and integration of technology into the curriculum. If technology integration and use is to become a part of the classroom on a consistent basis, the training should happen while preservice teachers are being educated. Pre-service teachers often are not exposed to the uses of any technology in the school classrooms as they observe and do field experience, so they do not understand the importance of training before they

enter the teaching work force. "We teach as we were taught, therefore, teachers rarely see examples of technological integration into the curriculum after which they can model their own teaching" (Davenport, 1995). University professors do not model the uses and integration of technology, so it is difficult for students to imagine the uses of such things as hypercard, multimedia presentations, and interactive video. Beaver (1990) stated that there is a void in the training of teacher education faculty and this void is passed on to their undergraduate students.

The Study

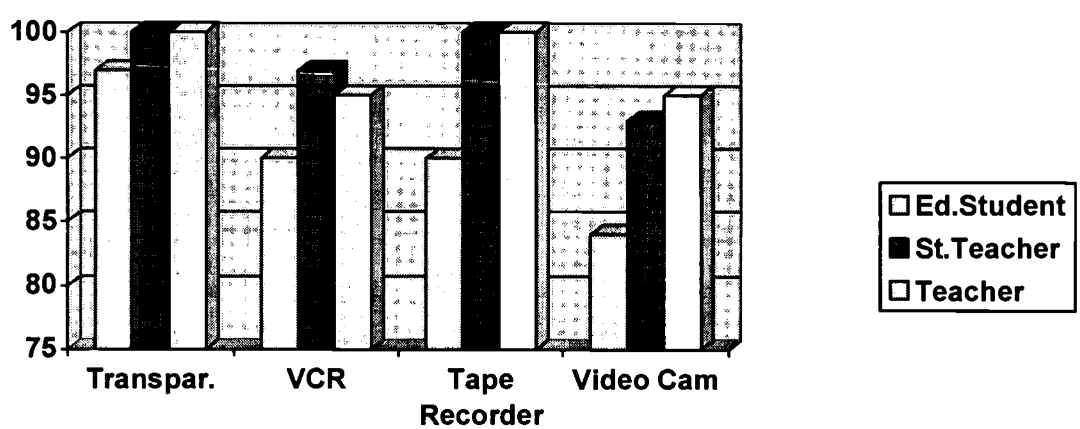
Three surveys were developed to ascertain the attitudes, beliefs, and preparation of in-service teachers, pre-service teachers, and student teachers. The sample population surveyed included: 1) all teacher certification students, elementary and secondary, enrolled in education courses. These were University juniors, seniors and post-baccalaureate students; 2) all student teachers enrolled in either Elementary or Secondary Classroom Management; 3) in-service elementary and secondary teachers in various school districts in San Antonio. The final results and analysis of the data from these surveys were compared with data gathered over the past seven years regarding the uses, integration, training and attitudes concerning the use of technology by pre-service teachers in the teacher certification program at St. Mary's University. A four-point scale was chosen to force respondents to either agree or disagree with each survey statement.

Findings

The findings were as follows:

Comfort Level with the use of Common Technologies

	Transparency	VCR	Tape Recorder	Video Camera
Education Student	97	90	90	84
Student Teacher	100	97	100	93
In-Service Teacher	100	95	100	95

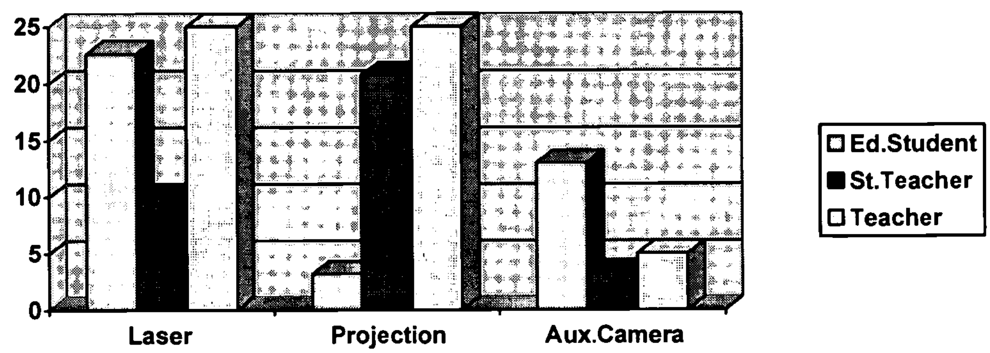


These Comfort Levels indicate that all parties felt confident in using the common technologies that many have in their own homes; namely, the VCR, tape recorder, and video camera. They also felt confident in the use of the

overhead projector with transparencies, the most common technology in classrooms. The levels of comfort were generally highest for those most experienced with the technology.

Comfort Level with Use of Newer Technologies

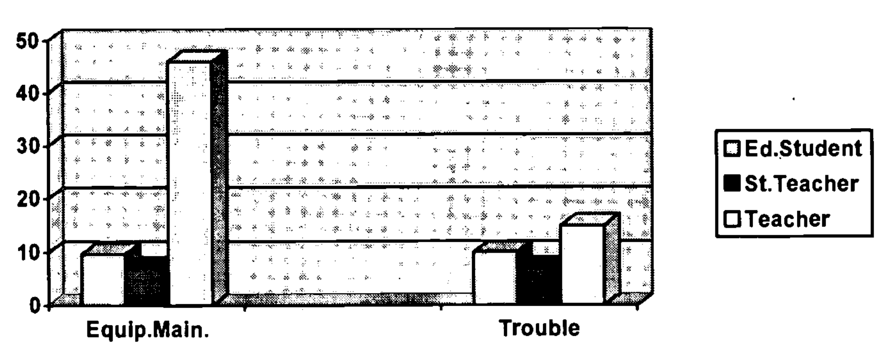
	Laser Disc	Computer Projection	Auxiliary Camera
Education Student	22.6	3.2	13
Student Teacher	10	20.7	3.3
In-Service Teacher	25	25	5



The Comfort Levels with the use of the newer technologies, however, was sharply lower, with education students lowest, followed by student teachers and then in-service teachers. These technologies, laser disc, computer projection and an auxiliary camera are the technologies which enable teachers to integrate information from the web and laser discs into the curriculum. However, teachers have not been trained in the use of them and feel very uncomfortable trying to do so.

Lowest Comfort Levels

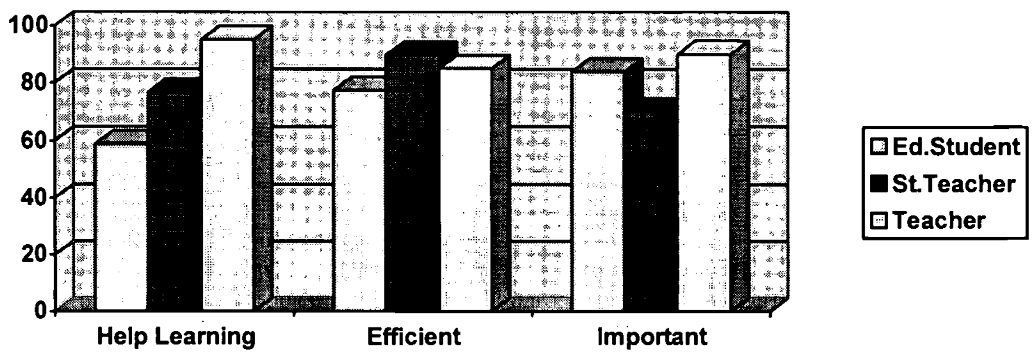
	Equipment Maintenance	Trouble Shooting
Education Students	9.7	10
Student Teachers	7	6.9
In-Service Teachers	15	15



The lowest Comfort Levels were with equipment maintenance and trouble shooting. Teachers are often not willing to try to use technology in their lessons because of fear that the technology will not work and they will not know what to do about it or know how to make it work. Therefore, it is "safer" to teach with the tools they are familiar with and know they can rely on; namely, textbooks, chalk and chalkboard, overheads, and perhaps a video from time to time.

Beliefs about Use of Technology for Education

	Help Students Learn	Efficient	Important in Schools
Education Student	54.8	77.4	83.9
Student Teacher	76.7	89.7	70
In-Service Teacher	95	85	90



Overall, all subjects believe that technology for educational purposes helps students learn, makes students and teachers more efficient, and is important in schools. It seems that they want to be able to use the technology, integrate it into the curriculum, view it as an assistive learning tool, they just do not know how, feel uncomfortable with making sure it will work correctly, and have not been trained in the most current uses.

Conclusions

If we are to truly effect change in the way teachers are teaching and have technology integrated into the curriculum, we must change the way teachers are trained in their preservice education. To affect this change, St. Mary's University has developed a new technology course for teacher certification students. It will be taught by computer department faculty with input from education department faculty and will stress advanced skills integrated in unit and lesson plans in the content areas. The progress of the university in providing technological support for students, professors, and support staff and the future plans for meeting this ever-changing frontier will be analyzed and compared with national trends to determine further necessary course development, content and training at the preservice level. Implications for further study and for training design will be examined.

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INTEGRATING COMPUTER TECHNOLOGY IN CLASSROOMS: TEACHER CONCERNS WHEN IMPLEMENTING AN INTEGRATED LEARNING SYSTEM

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Abstract: Schools cannot expect to obtain gains in learner achievement from computer technology if it is not properly implemented. The concerns of teachers in integrating computer technology in the classroom may impact how computer technology is ultimately implemented. This study examined the concerns of elementary school teachers implementing computer-delivered instruction. The findings of the study support the position that teachers' concerns and perceptions of an ILS influence the way in which they implement an ILS.

Introduction

The usual expectation associated with the integration of computer technology into instruction is that it will enhance student learning while significantly reducing instructional costs (Green & Gilbert, 1995). Unfortunately, during the last decade the rapid deployment of computer technology in classrooms created several problems. For instance, it was not unusual for a school to install computers and educational software and learners begin to use the computer systems before anyone questioned the implementation of the technology. The problems associated with the implementation of computer technology were intensified when schools lacked adequate funding to train teachers in the appropriate implementation of this technology. The entire process by which computers and learners came together in schools was often "inefficient, poorly planned, and incredibly chaotic" (Maddux, Johnson, & Harlow, 1993, p. 220).

Implementation in schools is the placement of an innovation in the instructional process and is distinguishable from adoption because many innovations are adopted but never implemented (Bond, 1988). Fullan and Pomfret (1977) described implementation as a "phenomenon in its own right" (p. 336) and suggested implementation studies should measure the correspondence of actual use of an innovation with its intended use. Hord and Huling-Austin (1986) cautioned that implementation does not equal delivery of an innovation and that users of an innovation do not necessarily implement an innovation in the way it is intended to be used. Smith and Ragan (1993) advised that "in drawing the line of causation from the instruction to the results, it is critical to be able to identify the degree to which the description of the program represents what actually occurred during instruction with the new program" (p. 416).

The process of educational change and innovation that results from technology integration in classrooms is extremely complex. To deal with this complexity, educational change models often attempt to assess and explain the change process in terms of dimensions or degrees of change. For instance, researchers at the Apple Classroom of Tomorrow (ACOT) project observed distinguishable changes in classrooms in technology-rich schools and regarded instructional changes in ACOT classrooms as an evolutionary process in which teachers moved from concerns about technology to the development of powerful learning experiences for their students (Dwyer, Ringstaff, & Sandholtz, 1991).

Implementation is often difficult and complex due to the variety of curricular programs, computer platforms, and educational populations served by various courseware products. Consequently, schools cannot expect to experience gains in learner achievement and motivation from computer technology if it is not properly implemented. One type of computer-delivered instruction that accounts for a significant share of the educational software market is integrated learning systems (ILSs). ILSs are computer-delivered instruction packaged as comprehensive software systems operating on networked hardware platforms. ILSs provide a

multi-year curriculum sequence of instruction that is controlled by a management system enabling teachers to assign lesson sequences, monitor learner performance, and generate learner progress reports. (Mills, 1994). ILS appeal seems to be based on the fact that ILSs offer a comprehensive one-stop solution to instructional computing (Robertson, Stephens & Company, 1993). By some estimates, ILSs account for nearly 50% of total educational software purchases (Bailey, 1993).

Several researchers postulated that the way in which users of an innovation perceived the innovation was fundamental to their level of use of the innovation (Fullan & Pomfret, 1977; Hughes & Keith, 1980; Kimpston, 1985). Hughes and Keith reported that an innovation as perceived by the potential user of the innovation and not the innovation itself was the critical variable in explaining the degree of implementation of an innovation. Kimpston reported that "teachers' beliefs and practices about the importance of and participation and involvement in curriculum implementation tasks were more pronounced for teachers who were most closely attending to the curriculum prescribed by the district" (p. 195). Hall, Wallace, and Dossett (1973) postulated that the concerns or attitudes individuals had about a change was an important dimension in the change process.

The role of the teacher in ILS implementation is particularly important because much of the decision-making about how the technology is used is often the responsibility of the individual teacher. In fact, teachers have considerable discretion in determining whether an ILS is even used or not in accomplishing educational goals. The concerns or attitudes that teachers have about the use of an ILS and computer technology in the classroom are fundamental elements in the educational change process and may impact how the technology is ultimately implemented. This study examined the concerns of elementary school teachers implementing ILS technology.

Stages of Concern

Hall, George, and Rutherford (1986) described the concept of concerns about innovations as an aroused state of personal feelings and thought about a particular issue or task and determined that certain demands of an innovation were perceived as being more important than others. Therefore, the type of concern and the degree of intensity about an innovation will vary on the depth of one's knowledge and experience using an innovation.

Stages of concern described how users perceived an innovation from the time they first became aware of it until they gained mastery of the innovation (Hall & Loucks, 1978). Users were initially concerned about how an innovation affected them personally and later became concerned with how the innovation impacted their work environment. A Stages of Concern Questionnaire (SoCQ) was developed from the original conceptualizations provided by Hall et al. (1973). Seven stages of concerns that users or potential users of an innovation had were identified (see Table 1). These stages of concern were distinctive but were not necessarily mutually exclusive (Hord, Rutherford, Huling-Austin, & Hall, 1987). The seven stages varied in intensity and, consequently, characterized the developmental nature of individual concerns.

SELF	0	AWARENESS	Little concern about or involvement with the innovation.
SELF	1	INFORMATIONAL	General awarenes and interest in learning more detail.
SELF	2	PERSONAL	Uncertain about the demands of the innovation, inadequacy in meeting those demands, and his or her role with the innovation.
TASK	3	MANAGEMENT	Attention is focused on the processes andasks of using the innovation and the best use of information and resources.
IMPACT	4	CONSEQUENCE	Attention focuses on the impact on students in sphere of influence.
IMPACT	5	COLLABORATION	Focus on coordination and cooperation with others usingnnovation.
IMPACT	6	REFOCUSING	Focus on exploration of more universal benefits from the innovation including possibility of changes or replacement with alternative.

Table 1: Stages of Concern about an Innovation (Hord et al., 1987)

The developmental nature of concerns was reflected by grouping the stages into three dimensions: Self, Task, and Impact (Hord et al., 1987). In the early stages of a change effort individuals were more likely to have personal concerns with the change while in the latter stages of usage of an innovation concerns about the task and the impact of the innovation on users became more intense. An individual was likely to have some concerns at all stages. According to Hall et al. (1986) subjects moved from unawareness and nonuse of an innovation into a more highly sophisticated use. Therefore, the intensity of concern was initially high in Stages 0, 1, and 2 and ultimately high in Stages 4, 5, and 6. To interpret the SoCQ, an overall view of the relative intensity of different stages of concern is developed to profile the intensity of the types of concerns among the respondents.

The SoCQ was developed and validated to provide a quick-scoring measure of stages of concern and is applicable to almost any educational innovation. The SoCQ focuses on the concerns of individuals involved in change. In an educational setting teachers are often the focus of change and innovation and so this instrument is generally used by teachers. For this study the SoCQ was adapted to measure the level of concerns of teachers implementing an ILS.

The instrument consists of 35 items that teachers rate using an eight point Likert scale. Percentile tables allow for converting raw scale scores. Percentile scores reflect the relative intensity of concerns by the user of an innovation in a particular stage. Interpretation of the SoCQ is performed by the examination of percentile scores for peak stages, second highest stage, and high stage for groups or individuals (Hall et al., 1986). To substantiate the internal consistency and reliability of the SoCQ for this study, a pilot study of 33 elementary school teachers from five elementary schools implementing an ILS completed the SoCQ. Total test reliability and item-total reliabilities were computed for each of the seven stages of concern scales. The pilot test yielded a coefficient alpha of .90 for the total scale and item-total reliability coefficients for Stages 1-6 were high ($p < .01$) while Stage 0 yielded a reasonably high item-total reliability coefficient ($p < .05$).

Method

To collect data for this study, the SoCQ was administered to all ILS-using teachers in four elementary schools in an urban school district implementing an ILS. Of the 93 teachers in the four elementary schools who were handed a questionnaire, 65 completed and returned the SoCQ for an overall return rate of 71%. Reliability coefficients were computed for each of the seven stages of the SoCQ employing a two-tailed test. The 35-item questionnaire yielded high reliability coefficients for all stages ($p < .01$).

To analyze the SoCQ, data item responses were grouped and summed according to each of the seven stages of concern. Raw scores were converted to percentile scores for each of the stages and response patterns were examined as high and second high stages of concern. Both the second high stage score and the peak stage score were evaluated. Overall, highest levels were at Stage 0 and second highest at Stage 1. Although there was an overall high response tendency among all the stage scores, high Stage 0 scores may indicate either an unconcern about the innovation or users who are more concerned about things not related to the innovation (Hall et al., 1986). Tables 2 and 3 provide matrices of the frequency and proportion of the high and second high stages of concern scores.

STAGE	0 Awareness	1 Informational	2 Personal	3 Management	4 Consequence	5 Collaboration	6 Refocusing	High Stage Total
0 Awareness		12	9	9	1	1	3	35
1 Informational	5		3	0	1	1	0	10
2 Personal	0	4		0	0	0	0	4
3 Management	2	4	3		0	1	0	10
4 Consequence	1	0	0	0		0	2	3
5 Collaboration	1	0	0	0	0		0	1
6 Refocusing	1	0	1	0	0	0		2
2nd High Stage Total	10	20	16	9	2	3	5	65

Select Highest Stage of Concern from left column and read across for Second Highest Stage of Concern.

Table 2: Frequency of Highest and Second Highest Stages of Concern, n=65

STAGE	0 Awareness	1 Informational	2 Personal	3 Management	4 Consequence	5 Collaboration	6 Refocusing	High Stage Total
0 Awareness		18.5%	13.8%	13.8%	1.5%	1.5%	4.6%	53.8%
1 Informational	7.7%		4.6%	0.0%	1.5%	1.5%	0.0%	15.4%
2 Personal	0.0%	6.2%		0.0%	0.0%	0.0%	0.0%	6.2%
3 Management	3.1%	6.2%	4.6%		0.0%	1.5%	0.0%	15.4%
4 Consequence	1.5%	0.0%	0.0%	0.0%		0.0%	3.1%	4.6%
5 Collaboration	1.5%	0.0%	0.0%	0.0%	0.0%		0.0%	1.5%
6 Refocusing	1.56%	0.0%	1.5%	0.0%	0.0%	0.0		3.1%
2nd High Stage Total	15.4%	30.8%	24.6%	13.8	3.1%	4.6%	7.7%	100.0%

Select Highest Stage of Concern from left column and read across for Second Highest Stage of Concern.

Table 3: Proportion of Highest and Second Highest Stages of Concern, n=65

Stages of Concern Profiles

When scores were considered and viewed by individual school, trends were more obvious and easily interpreted. Therefore, a profile for each school was formulated. These profiles include charting the SoCQ cumulative scores compared to the mean overall trend (see Figure 1).

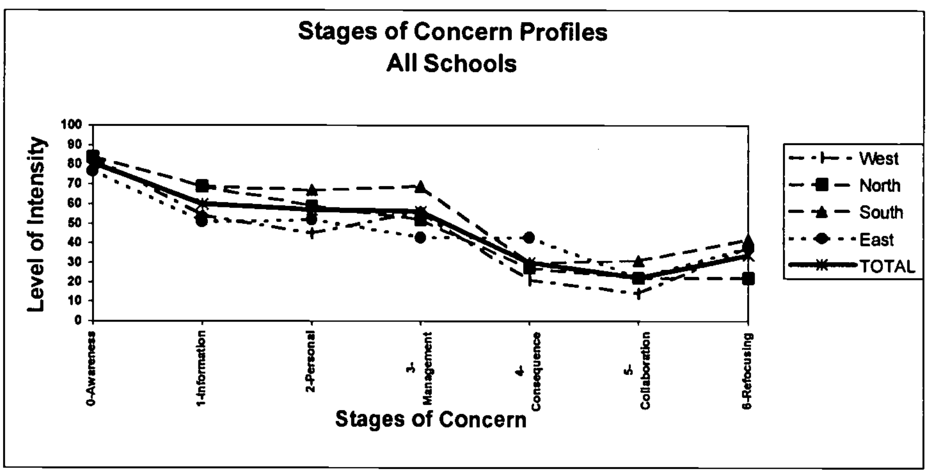

Figure 1: Stages of Concern Cumulative Scores by School and All Schools

West Elementary. A high *Stage 0 — Awareness* indicated established users who were no longer particularly concerned about the innovation (the ILS) or users who were more concerned about things not related to the innovation. The second peak at *Stage 3—Management* suggested that teachers had logistics, time, and management concerns. The tailing-up on *Stage 6—Refocusing* suggested that teachers had ideas about how to improve the use of the ILS. There appeared to be a progression from self concerns (Stages 0, 1, 2) to task concerns (Stage 3). Task concerns are typically more intense during the early period of use of an innovation (Hall et al., 1986).

North Elementary. The SoCQ profile for North Elementary suggested a general awareness and concern about the innovation and an interest in learning more about the innovation (Stage 1 slightly higher than Stage 2). Although a high *Stage 0—Awareness* indicated established users who were no longer particularly concerned about the ILS or were more concerned about things not related to the innovation, a second high *Stage 1—Informational* suggested that teachers wanted more information about the ILS. With the absence of peaking at *Stage 3—Management*, there was no clear indication of progression from self to task concerns. Low *Stage 4—Consequence* and *Stage 5—Collaboration* suggested some lack of concern about consequences for learners. The tailing-off at *Stage 6—Refocusing* revealed no other ideas were competitive with the use of the ILS.

South Elementary. The profile for South Elementary resembled the profile of West Elementary except at higher levels of stage scores. A high Stage 0 indicated established users who were no longer particularly concerned about the ILS or users who were more concerned about things not related to the ILS. The second peak at *Stage 3—Management* suggested that teachers were transitioning to logistics, time, and management concerns and clearly indicated a progression from self concerns (Stages 0, 1, 2) to task concerns (Stage 3). The distinct tailing-up on *Stage 6--Refocusing* indicated that teachers had ideas about how to improve ILS use.

East Elementary. The SoCQ profile for East Elementary suggested a slightly different spin on the interpretation than that of the other schools due to modest differences in the response pattern. Although a high *Stage 0—Awareness* indicated established users who were no longer particularly concerned about the ILS or were more concerned about things not related to the innovation, *Stage 2—Personal* concerns were equal to or more intense than *Stage 1—Informational*, which suggested users were concerned more about how they were affected personally by the innovation than in learning about the substantive nature of the innovation (Hall et al, 1986). The peaking at *Stage 2—Personal* also suggested that teachers had personal concerns and consequences for themselves. The distinct tailing-up on *Stage 6—Refocusing* clearly indicated that teachers had ideas about how to improve the use of the ILS.

There appeared to be some progression from self concerns (Stages 0, 1, 2) to concerns about the impact of the ILS on learners (Stage 4) based on the peaking that occurred at Stage 4. The difference in the concerns pattern for East Elementary compared to the overall pattern of concerns for all four schools, particularly in regard to *Stage 4—Consequence* concerns, were due, in part, to the fact that this school (both principal and teachers) had been implementing the ILS for a longer period of time than the other schools.

Although the frequencies of highest stage of concern levels were at Stage 0 and second highest at Stage 1, the overall trend for the SoCQ seemed to indicate a slight peaking of concerns at *Stage 3—Management* and then a distinct peaking at *Stage 6—Refocusing*. This pattern would seem to suggest an implementation where, on average, concerns for the innovation were evolving from a dimension of self concerns to a dimension of task concerns. Additionally, the tailing up at Stage 6 supported the notion that the average implementer had ideas about how to change or improve the innovation.

Discussion of the Data Analysis

The developmental nature of individual concerns about the ILS was apparent in both the overall profile, the school profiles, and the individual profiles of the stages of concern. Three of the schools in the study (West, North, and South) had been implementing an ILS for a little less than two years and the fourth school (East) had been implementing an ILS for a little less than three years. This distinction in the length of the implementation period between East and the other three schools was reflected by a progression to a higher level of concerns of East teachers on how the ILS impacts learners.

The teachers in this study most often expressed awareness, informational, or personal concerns. These teachers wanted to know more about an ILS—what an ILS is and how using it affects them. These expressions of concern were typical of a nonuser or inexperienced user. The peaking on *Management* concerns indicated some movement along the concerns continuum from self concerns to task concerns. According to Hord et al. (1987), *Management* concerns become more intense during the early period of use of an innovation. The peaking at *Stage 4--Consequence* concerns by teachers at East Elementary who had been implementing the ILS for a year longer than the other teachers in the study indicated that these teachers were just beginning to be concerned about the impact of the ILS on learners using the ILS.

Regardless of the level of concern about the ILS, most users had refocusing concerns—ideas about improving the ILS that would make it work better. This phenomenon is more indicative of experienced users of an innovation who have used the innovation with efficiency for some time and are concerned with finding better ways to impact learners. One explanation for this phenomenon in this study may be a lack of a basic understanding or knowledge about the ILS that may have been the result of a lack of sufficient training. Rogers (1983) suggested several reasons for re-invention of an innovation that may apply to these findings: (1) the complexity of the innovation, (2) a lack of detailed knowledge about the innovation, (3) an innovation with many possible applications, and (4) an innovation that is implemented to solve a wide range of problems.

The findings of the study support the position that teachers' concerns and perceptions of an ILS influence the way in which they implement an ILS. Implementation of an ILS doesn't happen by itself. ILS implementation is a complex and prolonged process that must be nurtured and sustained. The concerns of users of an ILS change and reformulate over time to reflect a relative intensity that corresponds with the users' level

of experience using an ILS. The reality of organizational change and innovation in schools is its contingency on social conditions and human interactions more than on technological feasibility or cost-benefit (Jaffee, 1998). For schools to experience significant change or reform due to the integration of computer technology in classrooms, the existing instructional concerns and practices of teachers must be carefully considered. Furthermore, the integration of computer technology must be approved, accepted, and implemented by teachers for computer technology to ultimately impact student learning while reducing instructional costs.

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THE ROUNDTABLE:
A CONSTRUCTIVIST APPROACH TO DEVELOPING GRADUATE STUDENT RESEARCH, WRITING AND PUBLISHING SKILLS

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Abstract: Drawing upon a Constructivist design, in particular, Cennamo's Layers of Negotiation Model, which emphasizes reflection, articulation, and exploration, The Roundtable hopes to help graduate students help themselves in developing the skills necessary to become accomplished, successful journal writers and conference presenters. In learning good research methods, members navigate their way through the multitude of journals available for publication, learn to write to their intended audience, and finally, face the expectation of regular submissions of journal manuscripts and conference proposals.

Graduate students hear it all the time, "That would make a good article. Why don't you research that and write it up?" For experienced faculty members and researchers, this comment is no big deal. They can often turn out article after article without giving the process a second thought. But, for many graduate students, this may be their first exposure to a lifelong expectation – publish or perish. How do you publish if you've never done it, and don't know how?

Asking themselves this question, doctoral students in the Instructional Technology program at Iowa State University decided to try to rectify the situation. Meeting for a brainstorming session in Feb. 1998, they agreed that the best way to tackle the problem would be through a peer support group.

The Design Process

The initial task was to accept and explore the overall complexity of designing such an entity. Interested members began by outlining what they thought the group should and shouldn't do. Since no one in the program had experience with such a group, there was no prior knowledge to draw from, the members had a blank slate upon which to do their design.

Meeting both formally and informally, the group began to take shape. Adhering to Constructivist principles, and following Cennamo's Layers of Negotiation model of design, provided structure and guidance as members outlined what each envisioned the group becoming. Members met both formally and informally as they agreed to certain principles.

Hierarchy

First, it was agreed that the group would have no formal hierarchy of "command". Since all the members were graduate students of more or less equal standing, a formal hierarchy made no sense. Instead, group members agreed that members of the group should, at varying times, each be responsible for leading the discussion, providing information to other group members, or otherwise directing the group's activities. For example, one week Student A may be responsible for providing a mini-lesson on developing Internet search skills. The following week, Student B may be responsible for providing a cheat sheet on editing marks.

It was essential that the membership acknowledge that peer constituents possessed information worthy of their time and effort. Each member offers a different piece of the puzzle, and has an equal say in the progression of the group as a whole. This is exhibited week after week, as members offer suggestions for changing the agenda for the either the current week, or for coming weeks.

Similar Groups

As members continued to define what their group should be, they began searching the literature for other groups of similar nature. A group at the Washington University, the PhD Student Writers Group, was of particular interest (Page-Adams, Cheng, Gogineni, & Shen, 1995).

The Washington University group began with six doctoral students in the fall of 1992. Of those students, four submitted or published at least one paper. Group members wrote, submitted or published a total of 19 papers during their first year. As a comparison, non-group doctoral students in the same program, produced a total of five papers during the same time period (Page-Adams et al., 1995).

Reflection

Building upon this foundation, Roundtable members began to set goals for themselves. At this point, step 3, Examine information relevant to the design of the instruction at multiple times from multiple perspectives, and step 4, Nurture reflexivity in the design process, proved of extreme value (Cennamo, Abell, & Chung, 1996). Members found that in order for the group to succeed, it would be necessary to look at the questions, concerns and desires of each member from several different points of view. Was a request to learn Internet searching skills really a request to learn searching skills, or was it really a request to look at the expansion and exploration of a research idea in its early stages. By taking on and examining different points of view, members began to understand that the question raised on the surface rarely reflected what was happening deep within the other person's mind.

Reflection was a natural element of the group's progression. By constantly examining and adjusting the group's ability to match each individual's needs, it was easier to continue to hone in on those individual needs. Since graduate students are notoriously short on time, members found it very effective and helpful to begin each session by evaluating what worked in the last meeting and what didn't work. This became a natural part of the meetings, and of the continual design process.

Meeting Goals

As members continued to define and shape the group, the calendar indicated that the first set of deadlines was quickly approaching. Members had set for their first goal that each member would submit a minimum of one conference proposal for the spring conference "season". It was time to put the group to its first test.

Each member was told to select at least one research idea and one conference appropriate for presentation of that idea. Members then began meeting two and three times a week, encouraging, supporting and coaching each other through the submission process. This presentation and the accompanying conference proposal and paper are all a result of this group process. While each member is responsible for developing individual publications and proposals, this particular presentation represents the ability of the Constructivist design and learning process to succeed.

The group effort proved successful. Each member had at least one proposal accepted for at least one conference. Some members had multiple proposals accepted for multiple conferences. All group members reported that they felt their success was due, in part, to the advice, guidance and support they received from other Roundtable members.

Expanding the Group

Once the initial goals of the group had been met, Roundtable members decided it was in the best interest both of the individual members and of the group as a whole, if membership were expanded to include any interested graduate student or faculty member in the Instructional Technology department. Opening the membership garnered three additional members, one doctoral student, one masters student and one faculty member.

This expansion of membership proved invaluable for the group and its membership. Upon the initial announcements that the group was soliciting new members, several individuals expressed an interest in membership. However, upon further reflection, many of these people felt that they were not ready, or did not require the support, of a group with such intense expectations and goals.

Members used this "rejection" as a means of further defining the goals and expectations for the Roundtable. Were the expectations too high? Were the goals too lofty? Members reflected on this, and other issues which had been raised. It was determined that those members who had chosen to participate had chosen to do so specifically because of the high expectations of members. While the group does continue to include a masters student, it was decided that this type of group might not appeal, or be of benefit to, the "average" masters student. The goals and expectations of the Roundtable relate to helping doctoral students develop into competent, polished professionals capable of submitting publishable articles and conference proposals.

Conclusion

Members of the Roundtable continue to meet and refine the group on a weekly basis. Refinement may consist of something as simple as a suggestion, "I think we should...." Or, it may involve a request for a larger change in the structure or organization of the group. Members continue to adhere to basic Constructivist principles and to Cennamo's design model. While it would be comforting to declare the design of the group as "complete" or "right" within the Constructivist frame-work that isn't possible. This group will always be a work in progress. The recursion in the design process is infinite. Clients are able to "refine their needs as the project evolved, to clarify needs as additional data became available, and to constantly be involved in the decisions at each stage in the design negotiation process." (Cennamo et al., 1996) While we will never be able to truly measure the worth of such a group, the results will speak for themselves as members develop basic professional competencies, which will enable them to compete and survive in the publish or perish world of academia.

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Computer Technology In The Classrooms: What Teachers Say?

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Abstract: Computers are everywhere. However, when we compare the typical school environment to the business environment, it is noticed that schools have lagged far behind in implementing the use of computers. The results of implementation of computers in teaching and learning are apparently not as glorious as educators and researchers expected. Then, what classroom teachers believe today? What should we be aware of the implementation of computer technology in pre-service teachers training? Presenters randomly selected more than 57 pre-service and in-service teachers to talk about the computer technology in the classrooms. Based on teachers' perspectives, presenters found that some classrooms are still lacking of computers, which is definitely blocking the way of implementation of computer technology in the classroom instruction and learning. Presenters also realize that there is a difference between pre-service and in-service teachers' perspectives on how to use computers in the classroom settings. In this paper, presenters summarize teachers' perspectives, discuss the implementation of computer technology in instruction, and provide insight views of pre-service teachers training.

Computer technology is believed as a uniquely effective tool to revolutionize teaching and learning. It is so flexible that it can be applied to an almost unlimited variety of across subject disciplines and across an array of human endeavors (Maddux, Johnson, and Wills, 1997). Computers are everywhere. According to the national survey report, 100% schools own computers and the ratio of computer to students has become 9:1 in the United States (Electronic Learning, 1993; Office of Technology Assessment, 1995). Abrams (1996) believes that there will have about 30 million CD-ROM drives sold by the year of 1999, and at least 2,000 CD-ROM, videodisc packages will be titled for education. To face the challenge of computer technology, the Education Department has projected that all children in the United States will have access to Internet in their classrooms by the year 2000.

However, when comparing the typical school environment to the business environment, researchers notice that schools have lagged far behind in implementing the use of computers. Although computers become very common in the schools today, the incredible growth of the computer presence in the United States takes place dramatically in the business world (Maddux, Johnson, and Wills, 1997). The results of implementation of computers in teaching and learning are apparently not as glorious as educators and researchers expected. Then, at the time close to the end of the 20th century, what is the reality in schools? What pre-service as well as in-service teachers believe in the computer technology? What should we be aware of the use of computer technology in the classrooms, more specifically, in teacher education for the 21st century?

Eighteen pre-service teachers and eighteen in-service teachers at Kennesaw State University, GA, and twenty-one pre-service teachers at Bemidji State University, MN were randomly selected to participate in presenters' survey. Pre-service teachers were in their senior year's teaching methods classes. In-service teachers were graduate students in their education technology class. The survey include four short essay questions: 1) What kind of computer technology in available in your classroom or in the classroom you have observed? 2) If you have a computer in your classroom, what can you do with this computer to improve your teaching and students' learning? 3) If you have 3-5 computers in your classroom, what can you do with these computers to improve your teaching and students' learning? 4) If you can have a computer lab to use, what can you do with the lab setting to improve your teaching and students' learning? In-service teachers were also asked to talk about their computer technology implementation plans in their own instruction.

Computer facility in the classroom

The first survey question is: What kind of computer technology in available in your classroom or in the classroom you have observed? Teachers' responses to this question showed us an interesting picture. The responses are simple but the numbers of computers in the classrooms are varying from zero to six. Presenters found that the majority of schools at least have one computer in their classrooms. Some of classrooms, particularly, the classrooms in GA, have five or six computers. However, several teachers responded that they only have Apple II e or MAC II c computers in their classrooms. 11 out of 57 teachers answered that there is no computer in the classroom at all, although computers are available in the schools media centers or computer labs.

Computers are indeed everywhere. One hundred percent of schools have computers. Based on the results of survey, presenters found that the numbers and qualities of computers in the classroom are unbalanced. Although the ratio of students to the computers has dropped to 9:1 in the past years, nearly 19% classrooms have no computers. Although Pentium II, Power Mac, and more advanced multimedia computers have become very common, some of the classrooms still depend on their old Apple IIe, Mac IIc machines. It is no doubt that lacking of appropriate computer facilities in the classroom will block the way of implementation of computer technology in teaching and learning.

The implementation of one computer in the classroom

The second survey question assumes that there is a computer in the classroom. This question is: If you have a computer in your classroom, what can you do with this computer to improve your teaching and students' learning? Pre-service teachers responded that the computer can be used for learning word processing and keyboarding, for rewarding students who finish the assignments earlier, and for providing tests on computer. They also stated that it could be used to run software at different disciplines, to access Internet, and to make presentations with HyperStudio or PowerPoint. Besides, the answers were scattered from using computer for the enhancement of learning to using computers for instruction, unit and lesson planning, and grading. The interesting issue is that there were four out of 39 answers indicated having no idea of how this computer to be used in the classroom.

When asked the question of implementing one computer in the classroom, in-service teachers responded that one computer could be as a center for students based on a schedule table. Software such as Tom Snyder Rainforest Researchers, Accelerated Reading, Word Munches, Grolier's Encyclopedia, Magic School Bus Visits the Solar System were listed for the center use. Add-on story writing and editing activities were recommended. On the other hand, many of in-service teachers suggested that one computer in the classroom be used by the teacher only. Teacher can use the computer to write letters to parents, prepare lessons, design the instruction, create instructional materials, handouts, worksheets with word processing package, to keeping students' grading with spreadsheets, assess to e-mail for communication etc.

There obviously exists a difference between the responses from pre-service and in-service teachers. Pre-service teachers talked about the use of one computer in the classroom more generally, while in-service teachers had more specific and detail implementation ideas.

The implementation of 3-5 computers in the classroom

The third survey question is hypothetically dealing with an environment of 3-5 computers in the classroom. How are these computers can be implemented in teaching and learning? Pre-service teachers agreed that the computers can be implemented in center activities, be used for tutorial learning, and be connected to Internet for research. Other than that, computers can be used for students' daily free time.

There did have three responses related to subject matters. Those responses suggested to have computers be used as a language arts/math station, and be connected to daily teaching subjects, so that students can work at the station by turns, and reinforce their learning on an individual basis. However, there is no clear vision of the implementations of 3-5 computers in the classroom.

Comparing with pre-service teachers' answers, in-service teachers answered questions more realistically. In-service teachers believed that 3-5 computers in the classroom can be used for students' group activities in a rotating manner. Group of students can work on writers' workshop, compose newsletters, and conduct research on the Web. They can practice budget planning with spreadsheets, compile data with database, and work on group presentation together. With 3-5 computers in the classroom, teachers can design various activities for reinforcement of subject teaching and learning, such as letting students work in group to create presentations with Power Point, or Hyper Studio based on the unit/chapter learning.

The implementation of computer lab settings

Nearly every school has at least a computer lab, although some of the labs are not up-dated with newly developed computers and other facilities. With a computer lab setting, a teacher's implementation approach will certainly be different with one-computer or 3-5 computers setting in the classroom. Pre-service teachers' responses included: hands-on learning, whole class activities, writing stories or papers, working on software, learning programming, conducting research, having individual learning, learning about computer and word processing skills. There were also two opposites in the responses. The two answers were very general. One indicated that the computer lab could do "a lot." On the other hand, one expressed "not sure" of how to use computer lab environment for teaching and learning.

With a computer lab setting, in-service teachers' responses implied that whole class could work on a same program, such as reading or math series program at individual's learning pace. Students could have e-mail pals to facilitate multi-cultural learning, practice writing and publishing on computers, and learn how to operate computers, handle diskettes, and work with some available packages, such as KidsPix, ClarisWorks, HyperStudio, etc.

Both pre-service teachers and in-service teachers suggested that the computer lab setting is good for every student to have hands-on learning, particularly to have basic computer skills training. Should we have the curriculum taught in the classroom aligned with the facilities, both hardware and software packages, in the computer labs? Should we have students' learning activities more connected to the classroom teaching? And how can we strategically and pedagogically use computer lab setting to improve teaching and learning? The presenters did not find any related information in the teachers' responses.

In-service teachers' implementation plans

In-service teachers have their own classrooms, and were taking educational technology class at the time the survey was conducted. Therefore, the presenters asked them to talk about their implementation plans in the coming semester. The majority of in-service teachers showed their excitements of implementing computer technology into their teaching and students' learning. Most of them planned to apply their training in the technology class to their instructions in the classroom. The implementation of computer technology becomes more teaching subject related, more curriculum oriented. Here are selected examples of partial responses for sharing.

> [Talking about one computer in the classroom] I have two old Apple II E computers in my classroom. I was told that I would be receiving a new multi media computer center. I hope to be able to do some of the same things that we did in here [in the education technology class]. I would use the new computer as an incentive for the students in my class. When their work was complete, they would earn points which would be transferred to computer minutes. Three students would be assigned to the computer at a time. Hopefully when the school year begins I will have a brand new multimedia station which combines a computer, monitor, printer and laser disc together. I will use this system to develop lesson plans, PowerPoint presentations, and outlines of class lectures and discussions, generate tests and keep class grades. My students will be able to use the station to make PowerPoint presentation for class projects.

> [With a few computers in the classroom] I plan having the students create a HyperStudio project on volcanoes. For this first project since many of my students may have not done HyperStudio before, I plan to create a template that they just have to fill out. I also will have the template and a picture file loaded on the server.
> I plan to use the web page I created in class weekly in my classroom. I have an "author of the week" and I plan to visit the page to share about the authors with my children.
> I also plan to keep my lesson plans on the computer so that in coming years I can go back and easily revise them for coming years. I am planning to use the computers to allow the students to type papers, create spreadsheets relating to our class, and present presentations using multimedia software such as power point. I have learned a lot this quarter [semester], and I can not wait to share this new knowledge with my students.
> I am very excited about using the spreadsheet and database programs for all kinds of things in my classroom. My teacher plan book will be beautiful, yet functional. I also plan to have my students do a biweekly newsletter to send home to parents. And certainly I will communicate more with parents using the database to send them personal letters about their child. I hope to be able to do slide presentations with Clarisworks for various thematic units as well. In addition I will have them do research and sorting tasks with various databases. I am excited!
>
> [With computer lab settings] I am planning to use the computers in the computer lab to do various writing assignments throughout the year. We will use it to create a database of books and authors we have read, including a rating of the book, a comment, a brief [1-2 sentences] summary, and whether it is an Accelerated Reader selection. We have this program at our school. This database would help students when they are choosing a book to read for their reading parallel credits. I would also like to incorporate Power Point presentations at various times as well as use the links that we put together last week so that students can go to the sites during our research paper on a writer.

Pre-service and in-service teachers' concerns have made us to rethink the integration of computer technology. First of all, computer facilities are the material basis of implementation computer technology in the classroom. Lacking of good quality computers, the implementation would be fruitless. Both classroom setting and lab setting are necessary to quicken the pace of implementation of computer technology in instruction and learning. One computer in the classroom is not enough but it is better than nothing. Teacher can use the computer for presentation, lesson planning, and instructional material designing. Three to five computers in the classroom are appropriate, so that teacher can have his or her own computer and students have theirs. Students can work at computers by groups or pairs. Meanwhile, the lab setting should and must be scheduled for individuals' hands-on learning and practice.

Second, it is also more important, teacher education program should include strategic and pedagogical computer technology training components. If the computer facilities are considered as a material basis of implementation, pre-service and in-service teachers' technology training are viewed as an intellectual foundation of implementation. Unless teachers know how to use the computers and what computers can be used for instruction and learning, they can take the advantages of computer technology and avoid its limitations, and integrate the computer technology into classroom teaching and learning.

The third area is the ways of training. Comparing pre-service and in-service teachers' responses to the survey questions, we can easily see the differences. One is oriented to respond in general terms of use computer technology, the other is tended to answer question with more specific and practical on the implementation plans. Presenters believe that teacher education program must be able to provide pre-service and in-service teachers with required and meaningful technology training. It is suggested that pre-service teachers' technology training can be integrated into service learning, let curriculum teaching and work experience make the training become more meaningful.

Finally, computer technology itself has nothing wrong. It is believed that education can profit from the computing in the classrooms. Still, there is no such thing as a free lunch. Computer technology has its advantages, it does have limitations in the classroom, it is a tool, like any other tools, it can be poorly or misused. How effective this tool can be used, depends on the tool user; how competent the tool

users can be, depends on the user's trainer. As far as prevention and invention strategies for problem domain computers bring into the classroom are concerned, prevention strategy is more important and essential in pre-service teachers training.

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A Comparative Study of the Impact of Technology Training on Teachers' Attitudes

by

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Introduction. The purpose of this study was to investigate the attitudinal changes toward technology as a result of the National Science Foundation/Northeast Louisiana University Teacher Enhancement Program (NSF/NLU TEP), which was funded in 1995 (Eaton, 1995). The attitudinal differences addressed within this study are in the areas of what is known as the New Information Technologies (NIT) - multimedia, electronic mail (e-mail) and the World Wide Web (WWW). In addition, other NIT areas such as the use of information technology to improve teacher productivity and an overall general feeling about technology were included in the study.

The Survey. Christensen and Knezek (1998), Teacher=s Attitudes Toward Information Technology Questionnaire (TAT 1.1) was used to collect quantitative data from selected K-12 schools in the Monroe City School (MCSS) and Ouachita Parish School (OPSS) systems. These schools were selected because they have successfully implemented a technology plan that provided Internet access for the chosen NSF/NLU TEP participants to utilize in their classroom training. Data was gathered for ten separate indices from the respondents. Zaichkowsky (1985) Modified Personal Involvement Inventory, a context free, sixteen- item semantic differential scale that focuses on Aa person's perceived relevance of the object based on inherent needs, values and interest≅ was modified to construct eight of the ten subscales used by the TAT (1.1) questionnaire. The other two subscales included instruments for comparative purposes: 1) Kay=s semantic perception of computers (Kay, 1993) and 2) D=Souza=s (1992) classroom via e-mail.

Approximately 400 questionnaires were delivered to the faculty of the MCSS and OPSS systems. Of these, 169 were returned for a return rate of 42 percent. The distribution of the returned questionnaires is given in Table 1.

Table 1
Faculty Distributions

LEVEL	MCSS	OPSS	TOTAL
Elementary	28	29	57
Middle	19	10	29
Secondary	54	29	83
TOTAL	101	68	169

The gender dichotomy represented 36 males and 133 females.

Table 2
Teacher Experience

Years	MCSS	OPSS	TOTAL
0 - 5	23	11	34
6 -10	14	21	35
11 -15	13	10	23
15+	47	26	73
TOTAL	97	68	165

Table 2 summarizes the type of training received and the number of respondents by system. As can be seen from this table, the TEP trained respondents represented 62 percent of the sample and were fairly balanced between the two systems. Fifty-two percent of the TEP trained teachers were employed by MCSS and 48 percent of the TEP trained teachers were employed by OPSS. This was not the case for the respondents who have training from other sources. Of the 65 respondents, 72 percent were from MCSS and 28 percent from OPSS. This discrepancy could be reflective of the level of commitment of the two systems.

Table 3
Distributions by Types of Training

Training	MCSS	OPSS	TOTAL
TEP Trained	54	50	104
Other Sources	47	18	65
TOTAL	101	68	169

In summary, 169 respondents returned the questionnaire for this research. Of the 169 questionnaires, 38 of the respondents omitted one or more of the subscales leaving 131 completed questionnaires. The two systems were adequately represented in both gender, level, and training received. The data collected exhibited an internal consistency reliability.

Overall Comparison of School Systems. As can be seen from Table 4 several significant effects are noted. The analysis indicated that differences between the two school systems and the training techniques exist for several of the attitudinal characteristics being investigated. The findings of this study indicated that MCSS teachers have a more positive attitude than their colleagues in the Ouachita Parish School system in 9 of the 12 categories studied. In addition to the differences between the two systems, the study also indicated that TEP trained teachers from OPSS have a more positive attitude than their counterparts within the same system in 5 of the 12 categories studied.

Table 4
Overall Comparison of School Systems

Analysis Level: Macro Approach		Hypotheses		
		MCSS vs. OPSS: Contrast 1	MCSS: TEP vs. Other: Contrast 2	OPSS: TEP vs. Other: Contrast 3
Latent Variables				
Factor 1	Technology	S	N	S
Factor 2	E-Mail	S	N	N
NIT Subclasses: Teacher				
F1	E-Mail	S	N	N
F3	Multimedia	S	N	S
F5	Productivity	S	N	S
F7	WWW	S	N	N
F9	E-Mail Classroom	S	N	N
F10	Computers	S	N	S
NIT Subclasses: Student				
F2	E-Mail	N	N	N
F4	Multimedia	S	N	N
F6	Productivity	N	N	S
F8	WWW	N	N	N

Significance Level: 0.05
Unless otherwise stated TEP > Other and MCSS > OPSS for all significant cells.
Note: S Significant
N Non-significant

As can be seen from this Table 4 (Contrast-1), MCSS teachers exhibited a significantly more positive attitude than their colleagues in OPSS when considering the two latent variables (Factor 1 and Factor 2) and the NIT subclasses of F1, F3, F4, F5, F7, F9 and F10. These findings indicated that MCSS teachers have a more positive attitude about the impacts of e-mail, multimedia, the WWW and computers in general than their OPSS counterparts. Furthermore, MCSS teacher exhibited a more positive attitude about the relationship between computers and their productivity and about using e-mail in the classroom. In addition to these findings, the MCSS teachers have a better perception about the attitudes of their students as it relates to the use of multimedia. The significance of the two latent variables Factor 1 (the general technology appreciation factor) and Factor 2 (the general e-mail appreciation factor) reinforces the

findings of the NIT subclasses and provides a multivariate procedure for assessing the attitudinal changes between the two systems.

When considering the effect of Training (Contrast-3), TEP trained teachers in OPSS have a more positive attitude about technology than their Non-TEP trained counterparts. In particular, the TEP trained teachers exhibited a significantly better attitude than the Non-TEP trained teachers for the latent variable Factor 1 and the NIT subclasses of F3, F5, F6 and F10. The latent variable Factor 2 and the NIT subclasses relating to e-mail (F1, F2 and F9) did not exhibit any discernible differences between the two training groups. The lack of discernible effects for the e-mail categories indicates that the training received did not affect attitudes about e-mail.

Training in MCSS (Contrast-2) did not produce any significant effects for the 12 categories under investigation. The lack of significance within the Monroe City Schools could be in part related to the type of training that the teachers received in the Non-TEP group. MCSS has been involved in technology training since 1991. In 1992 and 1993 several groups of MCSS teachers received training under the guidance of the staff of the TEP. The success of this program provided the foundation for the proposal that was submitted to and funded by the NSF. Thus, the non-significant effects observed with training in MCSS could be interpreted as an effect, which measures the effectiveness of the TEP. That is, the training of teachers by the TEP participants is as good as the training of teachers by the staff of the TEP.

In summary, TEP-trained teachers in OPSS have a more positive attitude than the Non-TEP trained teachers in OPSS when considering technology in general, multimedia as it relates to them, productivity as it relates to them and their students, and computers in general. These effects were only observed in the Ouachita Parish School system and not in the Monroe City School system.

Comparison by Grade Level. The analysis of the secondary school data indicated that differences between the two systems and the two training methods were present. Table 5 summarizes the findings of the analysis of the secondary school data set and shows that 9 of the 12 categories studied were significant between the two systems (Contrast-1) and 6 of the 12 categories studied were significant between the two training methods (Contrast-3) in the Ouachita Parish School system. Analysis of the training data in MCSS (Contrast-2), as with the overall comparison of school systems, was inconclusive.

Table 5
Comparison of Secondary Schools

Analysis Level: Micro Approach		Hypotheses		
Secondary Schools		MCSS vs. OPSS: Contrast 1	MCSS: TEP vs. Other: Contrast 2	OPSS: TEP vs. Other: Contrast 3
Latent Variables				
Factor 1	Technology	S	N	S
Factor 2	E-Mail	N	N	N
NIT Subclass: Teacher				
F1	E-Mail	S	N	N
F3	Multimedia	S	N	S
F5	Productivity	S	N	S
F7	WWW	S	N	S
F9	E-Mail Classroom	S	N	N
F10	Computers	S	S	S
NIT Subclass: Students				
F2	E-Mail	N	N	N
F4	Multimedia	S	N	S
F6	Productivity	N	N	N
F8	WWW	S	N	N

Significance Level: 0.05
Unless otherwise stated TEP > Other and MCSS > OPSS for all significant cells.
Note: S Significant
N Non-significant

The findings indicated that MCSS teachers have a more positive attitude than their OPSS counterparts for the latent variable Factor 1. Furthermore, the analysis indicated that MCSS teachers had a better appreciation for the NIT subclasses of F1, F3, F4, F5, F7, F8 and F10. These findings indicated that the MCSS teachers have a better appreciation for technology in general, e-mail as it relates to them, the impacts of multimedia and the WWW as it relates to them and their students, and computers in general.

With regard to training, the findings indicated that TEP trained teachers in OPSS have a more positive attitude than their Non-TEP trained colleagues for the latent variable Factor 1 and the NIT subclasses of F3, F4, F5, F7 and F10. These findings indicated that the TEP trained faculty in OPSS have a better appreciation for technology in general, the impacts of multimedia as it relates to them and their students, the impacts of the WWW as it relates to them and computers in general. Training in MCSS did not have a significant effect on the attitudes of the teachers. The underlying reason for this is probably due to the training that the MCSS teachers received by the staff of the TEP prior to the inception of the TEP.

The analysis of the middle school data was inconclusive and provided no discernible effects between the two systems and between the two training methods for both the latent variables and the NIT subclasses. Table 6 summarizes the findings of this investigation. The lack of significance probably was due to the missing Non-TEP trained group in OPSS. An interesting point did arise during the analysis of this data concerning the latent variable Factor 1 at the 0.10 significance level. At this significance level, the findings indicated that TEP trained teachers in OPSS have a more positive appreciation about technology in general than the TEP trained teachers in MCSS. This reversal in the attitudinal response is contrary to the above findings.

Table 6
Comparison of Middle Schools

Analysis Level: Micro Approach		Hypotheses		
Middle Schools		MCSS vs. OPSS: Contrast 1	MCSS: TEP vs. Other: Contrast 2	OPSS: TEP vs. Other: Contrast 3
Latent Variables				
Factor 1	Technology	S[1]	N	M
Factor 2	E-Mail	N	N	M
NIT Subclass: Teacher				
F1	E-Mail	N	N	M
F3	Multimedia	N	N	M
F5	Productivity	N	N	M
F7	WWW	N	N	M
F9	E-Mail Classroom	N	N	M
F10	Computers	N	N	M
NIT Subclass: Students				
F2	E-Mail	N	N	M
F4	Multimedia	N	N	M
F6	Productivity	N	N	M
F8	WWW	N	N	M

Significance Level: 0.05
Unless otherwise stated TEP > Other and MCSS > OPSS for all significant cells.
Note: S Significant
N Non-significant
M Missing
[1]A comparison of TEP trained in OPSS vs TEP Trained in MCSS and OPSS > MCSS.

The analysis of the elementary school data set was inconclusive and provided no discernible effects between the two systems and between the two training methods. Table 7 summarizes the tests performed and the results.

Table 7
Comparison of Elementary Schools

Analysis Level: Micro Approach		Hypotheses		
Elementary Schools		MCSS vs. OPSS: Contrast 1	MCSS: TEP vs. Other: Contrast 2	OPSS: TEP vs. Other: Contrast 3
Latent Variables				
Factor 1	Technology	N	N	N
Factor 2	E-Mail	N	N	N
NIT Subclass: Teacher				
F1	E-Mail	N	N	N
F3	Multimedia	N	N	N
F5	Productivity	N	N	N
F7	WWW	N	N	N
F9	E-Mail Classroom	N	N	N
F10	Computers	N	N	N
NIT Subclass: Students				
F2	E-Mail	N	N	N
F4	Multimedia	N	N	N
F6	Productivity	N	N	N
F8	WWW	N	N	N

Significance Level: 0.05
Unless otherwise stated TEP > Other and MCSS > OPSS for all significant cells.
Note: S Significant
N Non-significant

Effect of Technology Training on the Attitudes of Teachers and their Students. Proper technology training appears to be strongly related to teachers' attitudes toward computers and technology. It can be conjectured that training of colleagues by school district personnel who have received proper training is as good as training that was received from other professional services. This conjecture is supported by the attitudes of the teachers in MCSS who were trained by the TEP participants and the staff of the TEP, but this conjecture probably warrants further study on its own. Long-term commitment by districts also appears to be strongly related to teachers' attitude toward computers. This conjecture is supported by the differences in teacher attitudes between the two systems in this study. In MCSS, which has been involved with technology training since 1991, teacher attitudes toward technology were consistently more positive than the attitudes observed in OPSS. This long-term commitment conjecture should be studied in longitudinal studies of the two systems. The direct effect relating to impacts on students was weaker than the impacts on teachers in this study; however, an impact was present. The amount of impact best be addressed by surveying the students as well as the teachers. This conjecture could also be addressed in future longitudinal studies.

For quite some time now, professionals in the area of computer technology have been advocating that technology alone is not enough. Teacher training will reduce teachers' anxiety about technology and should be the focal point of any district's technology plan. Reducing teacher anxiety will give teachers the needed confidence to integrate technology into their classrooms.

It was apparent from this study that inadequacies in training exist. The secondary teachers in this study felt more comfortable and had a better appreciation for technology than did the teachers in the lower levels. Although the study did not take this into consideration, it could very well have been that the secondary teacher sample clustered on teachers whose academic training was in the areas of mathematics and science; whereas, the middle school and elementary school samples were not. Planning training sessions for the classroom teachers should emphasize their respective academic areas. That is, training should focus not only on those teachers in the mathematics and science fields, but also on teachers in other areas such as the social sciences, history, and languages. Realizing that not all students will become scientists and engineers, the school districts must put forth an unprecedented effort to train teachers who

will serve as role models for the students who will comprise the non-scientific work force of tomorrow. Thus, training must be grade-level and area specific.

In addition to training, this study indicated that long-term commitments to technology training were beneficial. Monroe City and Ouachita Parish School systems are very progressive in their efforts to not only infuse dollars into technology but also to infuse dollars into a broad based technology training program. These two systems are the leaders in the fifteen-parish area that comprises northeast Louisiana school districts. Yet, it was very apparent from this study that the teachers from the Monroe City School system had a more positive appreciation for technology than the teachers from the Ouachita Parish School system. This significant effect could very well have resulted from the fact that MCSS made the commitment to technology several years prior to the commitment from OPSS. Training was incorporated into the MCSS technology plan in 1991; whereas, OPSS began its involvement with training in 1995. The staff of the TEP program worked closely with the MCSS training program and this involvement provided the impetus for the teacher enhancement proposal that was funded by the National Science Foundation. Thus, commitment is essential. School districts must take that extra step and provide proper training for their faculty.

Recommendations for Future Studies. The entire area of teacher anxiety and perceived computer importance by students deserves additional longitudinal study. The longitudinal studies should be time and district driven. This study did indicate that within urban school districts such as MCSS and OPSS long-term commitment to training influences attitudes. This conjecture can only be assessed over time. The conclusions drawn from this research focused on urban schools and do support the research done by Christensen and Knezik and others. The conjecture here is "Commitment to training is long-term." What was not addressed in this research was the impact of training on both rural and urban schools. Are the same anxieties present in the rural systems as they are in the urban systems? Is training in the rural systems as good as training in the urban systems? Do the rural systems have the same commitment to technology as the urban systems? Are the level specific differences present in the rural systems as they are in the urban districts? These questions and others need to be addressed in the future. Our educational community needs direction. If we are to provide this direction, then studies need to be designed to address the issues and provide the guidance needed for successful implementation of technology into the lives of our faculty and their students.

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Effective Approaches To Teach Computer Applications To Teachers

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Abstract: Having a good command over basic computer applications is essential for teachers to integrate technology in the school. Teachers should learn how to maximize the power of computer for their teaching and administrative work. This paper focuses on some effective approaches that can help teachers learn to use computer applications successfully. First, common computer tasks were categorized based on their features. A series of enhancement instruments were designed and developed and implemented in computer application courses throughout a two-year period. Data were gathered and interpreted about effective approaches.

Overview

Computer has become an indispensable tool for teachers. Vockell and Sweeney (1993) point out that competent computer-using teachers used computers more often and in more effective ways than less competent teachers. Teachers today should learn how to maximize the power of computer for their work. Presently, there are more teachers using computers than ever. However, most computer-using teachers that we know spend time mainly on basic-level tasks, i.e., using word processing for typing papers or reports, browsing on the Internet, and sending e-mail. To take advantage of the capability that computers can offer, teachers need a higher level of computer expertise and an effective instructional approach is essential to help teachers master necessary computer applications and attain this level.

Teaching computer applications to teachers has presented challenges to college professors. Currently, computer application courses have become widely available in various teacher preparation programs. Many known factors, such as unequal access to hardware and software, diverse interest, background, and skill levels, insufficient learning resources, and inadequate platform differences, have discounted the computer instructors' effort and distracted the focus of proper instructional design and implementation.

There have been several studies examining how computers interact with users in the learning of application tasks. Larner and Timberlake (1995) suggest that the major obstacle to instructional technology is negative attitudes toward technology, and the lack of expertise or experience is the major reason for such negative attitudes. Studies also support that appropriate preservice and inservice training can reduce reluctance to use computers in classroom instruction (Brennan, 1991; Kolehmainen, 1992; Pina & Harris, 1993). Forcier (1996) points out that many researchers believe that one of the most effective strategies to engage teachers in acquiring the needed computer knowledge and skills is the task-oriented approach. To pursue effective approaches to optimize computer application instruction for teachers, the current study aims at exploring an integrative task-oriented approach and investigating effectiveness of various instructional devices.

Computer tasks and instructional enhancements

With many years of experiences in teaching computer applications to teachers, the author uses a modified framework, modeling the four domains of teaching (Danielson, 1996), which comprises planning and preparation, the classroom environment, instructional design, and professional responsibilities. To help learners appreciate the power and possibilities that computers may offer, task-oriented approach and hands-on activities are crucial to successful computer learning. However, simply putting teachers to work on computer tasks does not necessarily help them master needed skills and cope with the learning curve. An effective, meaningful approach is to connect the learning tasks with the learners' real-life experience. The author also finds that during teaching and learning, some tasks are more problematic than the others for certain users. With careful analysis, computer tasks may be categorized into the following three groups based on the nature of the tasks.

1. Conceptual tasks. The conceptual tasks include basic computer operational concepts such as how computer process information and how software operates. Some common examples for the conceptual tasks are as below.

- What is the difference between closing a document and quitting a program?
- How do computers process copying and pasting?
- What happened when a disk is initialized?
- How do computers handle graphics and text differently?
- Why do users have to specify a proper printer if more than one printer is connected to the computer?

2. Declarative tasks. The declarative tasks refer to the understanding of functions, features, and technical terms. The following are some common examples for the declarative tasks.

- Icon bar, tool panel, task bars, application menu, and ruler
- Justification, spacing, columnization
- Header and footer
- Macro or shortcuts
- Fonts, colors, and style sheet
- Cell references in a spreadsheet

3. Procedural tasks. The procedural tasks refer to intellectual steps to accomplish a given integrative task, or to trouble-shoot problems in a complex setting. The following tasks require the procedural knowledge.

- Organize a newsletter, make a calendar, create a slideshow, or customize a business card.
- Develop a database and a gradebook for an entire class.
- Correct some formatting errors by using search and replace function.
- Simplify the repetitive tasks with macro functions.
- Convert data files with different formats.

Although these task categories are fundamentally different, it is sometimes difficult to distinguish from one category from another. Frequently a procedural task may require the integration of various knowledge and skills from both conceptual and declarative task category. Smith and Ragan (1993) pointed out that in many cases conceptual and declarative tasks are essential to learning intellectual tasks. Anderson (1985) suggested that procedural knowledge must pass through the declarative knowledge stage. To enhance the computer application courses, examining the relationship between types of tasks and users' performances are indispensable.

Purpose of the study

This study focuses on various tasks, instructional device, and factors that may have contributed to teachers' successful learning of computer applications. Goals of this study are to explore the following issues:

- How do novice computer-using teachers differ from experienced computer-using teachers?
- How do inservice teachers differ from preservice teachers in computer learning?
- What kinds of devices can help novice users master the computer tasks and accelerate the learning curve?
- What factors can contribute to effective learning about computer applications for teachers.

The information regarding both preservice and inservice teachers' learning performance was collected. Other data from the past two years, including interviews with teachers, survey, and error frequency analysis from microcomputer application courses were also collected and interpreted.

Methodology:

Subjects:

The subjects of this study include 186 undergraduate preservice teachers and 112 graduate inservice teachers in the microcomputer application courses throughout four semesters in two years.

Instruments:

To assess students' performance, the following instruments were developed and used.

Initial survey: Students were surveyed for prior experience, interest, and attitudes toward computer applications.

Error log: Students were required to keep a weekly log and to report the errors they made.

Written quiz: Quizzes were used to assess if students had acquired needed conceptual and declarative knowledge.

Final portfolio: Students were required to develop an integrative portfolio to demonstrate what they had accomplished in the course in terms of tasks reflecting teachers' needs in a real classroom setting. They were allowed to focus on tasks related to either teacher's productivity or instructional enrichments or both. The grade for the portfolio was based on student efforts, thoughtfulness of the tasks, original ideas, creativity, and levels of difficulty. The final portfolio was used to assess intellectual procedural knowledge.
Assignments: Five types of exercises were given at various stages to help students consolidate their learning.
Post survey: Students were surveyed for perceptions about the usefulness of instructional enhancement device.
Final interview: Two students from each group were randomly picked for an interview at the end of each semester to provide feedback on the course.

Instructional enhancement devices
To help teachers smoothly and effectively master the learning of the application tasks, a series of instructional enhancements were designed and developed for this study. These devices are highlighted below.

- Detailed step-by-step information for the task in print and on the web.
- On-line help and tutorial.
- General information and terminology.
- Review of related tasks and features to the real life experience.
- Quizzes in the format of standardized test and on-line computer tasks as the formative evaluations.
- Team projects which provide students opportunities to learn from each other.
- A collection of model work samples and students' model work from the past.
- Five types of exercises, including, a) follow-along exercises as provided during in-class demonstrations, b) mock-up exercises as used after class to reinforce the skills learned, c) creative exercises (or open-ended mini projects), d) think-through exercises, and e) challenge exercises as to invoke deep thinking and application.

Procedure
Students (including all inservice and preservice teachers) started the course with an initial survey where they rated their own computer experience and skill levels. All students were then taught in depth about ClarisWorks, Netscape, and other application programs. As they made progress, they were asked to work on exercises, mini-projects, and portfolios. Students then reported on the errors they have made and the amount of time they had spent on which tasks. Students' quiz scores and final portfolio grades were also used to show their performance. At the end of the course, students were surveyed for their perceptions about the effectiveness of the instructional enhancement device. All data collected were analyzed to address the above-mentioned research issues.

Choice of the programs
ClarisWorks and Netscape programs were adopted as the primary tools for this study because they were readily available for various platforms in the computer lab. Both programs were also considered feasible to meet teachers' computer needs. Using the Netscape to browse the web as well as to construct a web page has been a popular practice that might increase teachers' willingness to put in good efforts for the exercises. ClarisWorks has been a popular integrated program which offers a wide range of tasks to address the needs in almost every aspect of teachers' work. In addition to ClarisWorks and Netscape, other popular programs, such as PowerPoint, HyperStudio, and some courseware titles were also adopted throughout the semester.

Results of the study

Student's self-reported computer experience and skill levels

Table 1. Self-rated as novice and experienced users

Computer experience	Preservice (Undergraduate)		Inservice (Graduate)	
Novice	63	21%	68	23%
Experienced	123	41%	44	15%

Students were asked to rate their own computer experiences and skill levels. Based on such information, they were categorized into four groups: preservice novice (PN=21%), preservice experienced (PE=41%), inservice novice (IN=23%) and inservice experienced (IE=15%) as shown in Table 1. Only a few students had prior experience in using the ClarisWorks and the Netscape, but their experiences were not extensive enough to affect the tasks to be learned and accomplished.

Error analysis of the computer tasks:

Table 2. Frequency of errors made for each knowledge categories as reported by students

	Conceptual tasks		Declarative tasks		Procedural tasks	
	Total	Average	Total	Average	Total	Average
PN (n=63)	958	15.21	1035	16.43	1534	24.35
PE (n=123)	578	4.70	674	5.48	718	5.84
IN (n=68)	1251	18.40	1358	19.97	1785	26.25
IE (n=44)	286	6.50	310	7.05	290	6.59
Total Novice (n=131)	2209	16.86	2393	18.27	3319	25.34
Total Experienced (n=167)	864	5.17	984	5.89	1008	6.04

Note: PN: Preservice novice; PE: Preservice experienced; IN: Inservice novice; IE: Inservice experienced

From what students reported about the computer errors they made for each task category throughout the semester, as shown in Table 2, it is obvious that novice users made more mistakes in all the categories than the experienced users.

What do they choose for mini-project exercises?

Table 3. Practice on advanced exercise and performance

	Mean Quiz Scores	Mean score for portfolio grade
Novice (n=131)	75.82	81.50
mockup tasks (n=89)	70.75	77.75
creative tasks (n=42)	86.56	89.45
Experienced (n=167)	92.10	82.40
mockup tasks (n=52)	87.95	77.95
creative tasks (n=115)	93.98	84.41

Students were given freedom to choose either basic mockup tasks or creative tasks for mini-projects as exercises. Although they were encouraged to attempt the creative tasks, many students chose to work on simple mockup tasks, as examples provided in class demonstration. As shown in Table 3, those who chose to do the creative tasks also performed better than those who did not. It is likely that those who chose to do mockup tasks did not feel comfortable or ready to do the creative tasks. The fact that fewer novice users chose to do integrative tasks may have explained this concern. However, the fact that those novice users who dared to try out the integrative tasks performed exceedingly well in their final portfolio probably suggests that integrative or creative tasks might help computer learners accomplish more.

Table 4. Mean quiz scores and portfolio grades between preservice and inservice teachers

	Quizzes	Portfolio
Preservice (n=186)	89	78
Inservice (n=112)	78.5	88.65

As shown in Table 4, undergraduate preservice teachers seemed to have better basic skills and did well on the quizzes. However, for the portfolio, the preservice teachers did not outperform the inservice teachers who had more experience in the public school classroom setting and had better ideas of how to apply computer skills.

Students' perceptions about the usefulness of the enhancement devices

Table 5. Mean scores of the helpfulness of the enhancement devices to learning

Type of enhancement device (Based on a 5-point scale of evaluation: 5=most useful)	Experienced users	Novice users
1. Detailed step-by-step information for the task	3.7	4.8
2. General information and terminology	3.3	4.7
3. Review and relate tasks and features to the real life experience	4.2	4.9
4. Quizzes	3.8	4.4
5. Team project	3.5	4.9
6. Model work samples/ group sharing	4.1	4.9
7. Exercises		
a. Mock-up exercise	3.3	4.8
b. Follow-along exercise	2.7	4.9
c. Creative exercise (open-ended project)	4.0	4.2
d. Thinking-through exercise	4.5	4.9
e. Challenge exercise	4.7	3.9

Based on a five-point scale survey (with 5 meaning most useful and 1 meaning least useful), students were asked to rate the usefulness of the enhancement devices for computer learning. The mean scores in Table 5 show that experienced users and novice users significantly disagreed on item 1, 2, 3, 7a, 7b, and 7e, where novice users appreciated receiving more general information and simple, easy-to-follow tasks.

Discussion of effective approaches

From the results of the study, the effective approaches may be characterized as the following.

- ***Computer time and access is essential***. Time spent on exercise is a widely known factor to the successful accomplishment of almost any learning tasks. Students who spent more time on the computer tasks performed better on both quizzes and the final portfolio than those who did not. Because both Netscape Navigator and ClarisWorks were available across the platform, a few teachers expressed their appreciation that they would be able to practice tasks at home. Six teachers bought new computers after they took the course because they sensed that easy access would make a greater difference for their learning.
- ***Move from basic to advanced tasks***. To accomplish the more complicated integrative tasks, users need to combine conceptual, declarative, and procedural knowledge and skills. Successful learners differ from the others not just in the knowledge and skills they have, but also in the way they explore computer programs. Those students who were flexible in trying out creative and integrative tasks performed better.
- ***The thinking-through process can help***. Thinking-through exercises may help students develop an ability to synthesize the information they have learned in order to develop more complex integrative tasks. A few novice students were not able to accomplish the given tasks and asked for help. When the tasks were analyzed and broken into smaller pieces, these students could handle individual tasks separately without problem. After the

thinking-through exercises, they understood the concepts and were able to accomplish the given tasks. The thinking-through exercise help students master tasks and gain confidence.

- ***Prior teaching experience is helpful.*** Several preservice teachers voiced concerns that they had no ideas about what kinds of teacher tasks they could do with computers. However, such concerns were not an issue for inservice teachers. This explains why preservice teachers had better conceptual and declarative knowledge (as shown in their quiz scores) but did not outperform inservice teachers on final portfolio. To help the preservice teachers, more model example tasks should be provided to help them connect their computer learning with real-life activities and to bridge the gap between preservice and inservice teachers.

Conclusion

Technology offers teachers the opportunity to become efficient at work and to conduct effective instruction. Task-oriented approaches to engage teachers in active learning about computer application is necessary but not sufficient. Teachers should acquire conceptual and declarative knowledge as well as the procedural knowledge described in this paper. The current study examined information about computer users' behavior and the type of tasks. Novice users needed to work on all types of tasks to improve their knowledge and skill levels.

To master computer applications, users should spend sufficient time on meaningful integrative tasks. The results suggested that practicing on integrative procedural tasks might help computer learners to perform better. The results also suggested that it is important to relate the computer tasks to the practical classroom setting and to lead undergraduate preservice students to become more aware of practicing teachers' tasks.

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Nonfictional Educational Narratives of Computer-Mediated Communication Technology Among Technologically-Novice K-12 Teachers: An Exploratory Methodological Study

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Abstract: This study explores the usefulness of the nonfictional educational story (NES) methodology in gaining a fuller understanding of computer-mediated communication (CMC) technology use among technologically-novice K-12 teachers. Three elementary school teachers were interviewed and exemplars of their experiences, perceptions, and feelings of CMC technology are presented. The results point to a potential of the NES method to alleviate the scarcity of qualitative research on what it means to be a teacher who potentially or actually uses CMC technology in the classroom.

With institutions of higher education and companies turning increasingly to the use of computer-mediated communication (CMC) technologies, students and new employees are expected to be familiar with their use (Scott & Rockwell, 1997). Yet, school systems are expressing fear that their graduates will be unprepared for the workplace because they lack experience and competence with technology (California Department of Education, 1996). Indeed, this fear is not unfounded as research suggests that new employees do not feel prepared to use CMC technologies (Siebold et al., 1992).

When seeking to understand why some teachers do not seem to implement CMC technologies in the classroom, the nature of teachers' perceptions of both CMC technologies and their uses in the classroom must be explored. Of particular relevance to the issue of low use of CMC technologies in the classroom is the technologically-novice teacher. Scott & Rockwell (1997) found that experience with CMC technologies is a substantial predictor of reported likelihood of future use. That is, teachers who do not have high experience with CMC technologies would tend to be the least likely to adopt and implement the technologies in the classroom. Thus, when examining the nature of teachers' perceptions of CMC technologies, concentrating on technologically-novice teachers may provide unique insight.

This research seeks to explore a method for understanding technologically-novice teachers' experiences, perceptions, and feelings of CMC technology use in the classroom. First, relevant research literature dealing with CMC technology adoption and use in K-12 schools is reviewed. Next, the research methodology used for gathering teachers' experiences is presented. Then, experiences, perceptions, and feelings of three technologically-novice teachers are detailed. Finally, implications of this research are discussed.

Background and Literature Review

Empirical research on actual CMC technology use in instruction is not as pervasive as the literature concerning the use of computer technology in general in schools. Yet, a review of recent research highlights several innovative uses. CMC technology has been effective in creating "global classrooms" among students in different geographic locations (Moss, Amodeo, Bullowa, & Detjen, 1997); facilitating foreign language learning through interaction with native speakers (Tella, 1992); encouraging understanding of global scientific phenomena (Leyden, 1997); providing students contact with subject matter experts (Sanchez & Harris, 1996); improving reading and writing skills, and interest in meaningful educational activities (Reil, 1990). Furthermore, Mackall (1996) suggests that CMC technology can bring an equality to traditionally disempowered students in the learning process. However, although research has investigated how CMC technologies are being used in the classroom, research generally has not looked at how the perceptions and experiences of the teachers influence decisions to use CMC technologies.

In order to give explanation as to why some teachers adopt technology and others do not, recent research has developed several models of technology adoption (for example, see Polin, 1992). However, a weakness of these models is that they tend to focus more on the process of adoption rather than on the internal concerns and experiences of the adopter (see Hall & Rutherford, 1977 for an exception). Moreover, research has generally not investigated adoption models in the context of CMC technologies. Indeed, Harris (1994) contends that additional aspects not usually investigated in regards to innovation adoption (e.g. critical mass) must be researched to gain a clearer explanation of CMC technology use in the classroom. Furthermore, a review of the literature also presents several common factors that encourage technology integration in the classroom: environments that are conducive to teacher exploration and mastery of the technology (Greenberg, Raphael, Keller, & Tobias, 1998; Hasselbring, 1991); ongoing training and support (Hasselbring, 1991; Sheingold & Hadley, 1990); perception of the teaching value of the technology and perception of administrators' expectations for use (Greenberg et al., 1998); ease of generating uses for the technology, and ease of access to the technology (Levine, 1995). However, research has generally not investigated these issues in regards to CMC technologies.

Methodology

Three elementary school teachers from three separate school districts in the southern United States were contacted and agreed to participate in this study. All were female and experience in teaching ranged from three years to twenty-seven years. All possessed only limited experience with technology and all indicated themselves as novice users of CMC technology both in an interview and on a survey instrument measuring degree of comfort with several common CMC technologies. In order to ensure privacy of the participants and all referenced individuals, all names of people and schools throughout this paper are pseudonyms.

As Norum (1997) observes, "The available research related to how technology is actually used in the classroom is thin; of what does exist, much of it is quantitative in nature . . . . Qualitative research, particularly narrative inquiry, provides insights into teachers' actual experiences with using technology in the classroom" (p. 17). The nonfictional educational story is a particularly useful method of giving voice to an individual teacher's experiences, perceptions, and subjective realities (Barone, 1992; Norum, 1997). Barone (1992) cites three qualities of the nonfictional educational story that serve to highlight its communicative usefulness: it is accessible in that academic jargon is kept to a minimum or absent entirely; it is compelling in that it makes use of the story format and engages the reader in the human drama; and it is characterized as being morally persuasive, which refers to a content that engages the reader to rethink subjective contentions by vicariously experiencing the intentions and desires of the protagonist. This exploratory research makes use of two narrative inquiry methods proposed by Connelly and Clandinin (1990): the unstructured interview and story telling. An initial interview was conducted with each of the three teachers and was followed by a second interview a few weeks later. The researchers focused on an interviewee-led open-ended format and encouraged episodic or anecdotal elements to provide the best information on the teachers' experiences, perceptions, and feelings and to draw the interviewees' attention away from simple or superficial answers to the questions.

Results

The stories are varied, both in the amount of data gathered and in the range of topics addressed. Time and access constraints prohibited equal coverage of the teachers. Nevertheless, unique and telling accounts of experiences, perceptions, and feelings were gathered.

Lisa, Southwest Elementary

The interview with first teacher, Lisa at Southwest Elementary, unfortunately gleaned the least amount of text; however, it detailed a specific instance of CMC technology use in the classroom. Lisa has been teaching language arts in a bilingual elementary school setting for three years. Of all of the three teachers considered in this study, she is the most technologically experienced. Her affect for computers is high as she has "always had a positive attitude about them." Yet, Lisa's use of computers in her classroom is not high. She

feels that involving computers in the curriculum takes a great deal of time relative to traditional instructional methods and she does not want the students to "get too involved in something that I know I won't have time to finish." When Lisa does use computers in her classroom she tends to focus on word processing software. However, that is slowly changing.

Lisa recently began to integrate PowerPoint, a multimedia presentation software application, into her curriculum. "I really like [PowerPoint] because it's more -- it's something that I used in college, so that's something that's real life and it's something that [her students] will use in the future if they hopefully go to college." When asked how the PowerPoint implementation was proceeding in her classroom, Lisa surprisingly began not to talk about how she was using the software to teach her content area, but rather about administrative assistance in teaching the students how to use the software. Her account hints at a deferment of responsibility in that another individual takes over and explains the software, leaving Lisa to potentially teach her curriculum content with the software. Interestingly, in this account Lisa's role as teacher is reduced to that of a monitor: "Then I had Mr. Jones come in. He's been a great big, a great big help. I mean, I just walk around and monitor. He explained [PowerPoint] very well to my kids in a way that I probably -- I mean he did a better job than I thought I could have. I didn't know how to explain it in a simple way." Thus, Lisa's narrative relates a story of a CMC technology potentially providing for the enhancement of the education in her classroom with the task of the teaching of the software being a responsibility of someone other than the teacher.

Tracy, Bayou Elementary

The second interview with Tracy at Bayou Elementary gives an account of a reluctance to use any form of computer technology in the classroom, including CMC technologies. Tracy has taught elementary school for twenty-four years. She first introduced herself to computers in the mid 1980s when she purchased a computer for her children. Later, she started using the computer herself for word processing rather than using a typewriter. Tracy reflects that this computer was not user-friendly and that whenever she wished to learn something new she found the manuals difficult to read. She purchased her most recent machine primarily for word processing, but also had it in mind to try e-mail and the World Wide Web. Tracy would like to learn more about using e-mail, but insists that she needs someone to help her learn it. She asserts that she does not have much time or money to spend on learning new skills and if she did decide to take a formal class about the Internet, she would not have any idea as to which class would be the most beneficial for her. "Just reading the books on how to do these things is too laborious," Tracy concludes.

Tracy expressed a substantial amount of apprehension toward computers in the interview. "They are smarter than I am!" she insists. "I'm always afraid that I'll accidentally trash something that I don't want to trash." Tracy reports that she likes using new software, but that she does not like learning how to use it. She is afraid she will ruin it or damage the computer itself. However, once she has had exposure to the software and tackled a good portion of the learning curve, she reports that her comfort level rises.

In regards to specific CMC technologies, Tracy has only limited exposure. Of all of the common CMC technologies, she has the most experience with e-mail, but uses it only for chatting with friends. Tracy does not see any educational value in the use of e-mail. She does not believe she would ever use it in her classroom because there are "too many things to worry about with the students using it." Additionally, Tracy has tried using the World Wide Web to try to find information, but reports little success. She would like to know how to "surf the Web," adding "whatever surfing the Web means." Interestingly, regarding CMC technologies of which she has no knowledge, Tracy believes that she has no need of them, otherwise she would have heard of those technologies. Thus, Tracy's story is that of the reluctant and passive teacher in regards to CMC technology use.

Jane, Pine Oak Elementary

The final interview with Jane at Pine Oak Elementary touches on teacher training and administrative support. Jane has been teaching for twenty-seven years, starting in second grade and has worked progressively down to kindergarten. For the first half of her teaching career, she used no computer technology in her classroom, but she has used technologies such as audio tape recorders and video recorders to frequently augment her lessons.

Five years ago, the administration began a concentrated effort to make computer technology prevalent in Pine Oak Elementary. During the first two years of the technology implementation plan, teachers were given minimal to no training and Jane found herself knowing little more than how to reboot the computers. In the third year Pine Oak instituted many inservices entitled Tea and Technology. They were well attended, but Jane did not find them always helpful. The classes were on specific subjects, such as how to make a newsletter or how to scan a photo. However, the classes included teachers of varying ability. Jane felt nervous next to more competent and younger teachers. "They say we're afraid to use technology, but that's not true," Jane asserts. "We don't know how and hate to admit we don't know anything." She characterizes the sessions as being too full, along with people becoming impatient and working ahead, and others becoming lost and frustrated. Jane was in the latter category. The two technologists would often lean over Jane's computer and just complete the action, saying "it's like this" instead of teaching her how to do it. Jane reports that many teachers left feeling as helpless as when they had arrived.

The school began to have many frustrated teachers as the administration's desire for technology implementation increased. Many quit or changed schools to avoid the technology push. Jane stayed, but moved down to kindergarten to avoid the more demanding technology, such as five page computer-generated report cards, multimedia book reports, and computer-based slide shows for Parent Night. Jane routinely commented bitterly on the whole issue. "[The] plans looked great on paper, but what they said and what really happened was a different story."

Nevertheless, Jane is also beginning to explore CMC technologies. She has recently started using email, now that the school uses it for lunch and attendance counts. Jane also finds herself using it to communicate with other teachers about class projects and even for sending humorous e-mails to them. She would like to know more about the World Wide Web. Currently, Jane is just beginning to explore it using search engines and often exclaims aloud how she found a valuable site and how she wishes to share it with other teachers. Jane attributes this newfound comfort to the presence of two new technologically-proficient teachers who use their computers right next to hers. She feels freer to try things on her own, because if she erases something or "messes it up," help is immediately nearby. This is the kind of personal attention she has always wanted in the inservices. In regards to the use of other CMC technologies, Jane has no interest in integrating video-conferencing into her curriculum nor in using it personally. However, she is interested in seeing how a chat room operates. Thus, Jane's narrative is that of a journey from unfamiliarity to exploration of CMC technologies.

Discussion

This exploratory study sought an initial understanding of the meaning of CMC technology for technologically-novice K-12 teachers. Three teachers were interviewed and exemplars of their stories were presented. In this section, implications of the research are discussed.

Lancy (1993) in his chapter on personal accounts laments, "Far too often, when I expected to read a report of research, I was treated to a lecture, in which the life history material was not analyzed, but selectively drawn on to illustrate the lecture" (p. 203). This paper seeks to avoid this trap by choosing not to advance a unifying argument among the three stories, but rather to analyze a specific instance in each narrative. In this manner, over-generalization and superficial consideration of the stories will be avoided.

A point of interest in Lisa's narrative is her assertion "I really like [PowerPoint] because it's more -- it's something that I used in college, so that's something that's real life and it's something [her students] will use in the future if they hopefully go to college." Looking at how someone constructs an utterance gives understanding to that utterance (Pomerantz & Fehr, 1997). Lisa begins by making the connection between college and "real life" and that the use of PowerPoint in her college validates it as being representative of such. This implies a perception that time spent in her elementary school classroom is not reflective of experiences in the social environment outside the classroom walls (i.e. "the real world") and that the introduction and use of PowerPoint in her classroom makes her teaching more representative of real life. That is, the integration of the CMC technology of PowerPoint potentially raises the level of the education so that it is more representative of the outside or real world.

Quite possibly the most fascinating aspect of Tracy's interview is her assertion that she sees no educational value in the use of e-mail. This is a puzzling statement especially in the context that Tracy has experience with e-mail and uses it routinely to communicate with friends. The key to understanding Tracy's ambivalence is in her statement "[there are] too many things to worry about with the students using it." What is

most striking about this utterance is its vagueness. These dangers of e-mail use in the classroom were never delineated nor gleaned from Tracy in the interview, pointing to the idea that Tracy herself cannot give specific examples of what these "too many things to worry about" are. Her additional statement in which she asserts that if she has not heard of the CMC technology she probably has no need of it may provide some insight here. This statement, too, is fairly vague. Moreover, it points to a lack of knowledge-seeking in regards to CMC technologies by Tracy. She does not appear to be all that interested in adopting CMC technologies in her classroom and that if such technologies are beneficial or necessary, she would then already know about them (e.g. perhaps mandated by an administrative body).

Jane's narrative almost reads like a critical theorist's success story. She has broken through administrative obstacles and is gaining increasing familiarity and comfort with CMC technologies. The most telling aspect of Jane's increasing familiarity story is that of social support. She lists two specific instances of CMC technology use in which she is gaining confidence: e-mail and the use of the World Wide Web. Both of these CMC technologies require social interaction for Jane. Her use of e-mail, both in sending and receiving, undoubtedly provides social reinforcement for her use of the technology. The same is true for her use of the Web in that she shares sites of interest with other teachers and this social interaction further supports her continued use of the technology. Additionally, Jane directly attributes her comfort and confidence to the specific situational circumstance of having technologically-proficient teachers within immediate reach of her own computer. It is interesting to examine why she might feel more comfortable, confident, and freer to try things on her own. Jane provides an explanation in that if she makes a mistake, help is immediately nearby; yet the explanation may go beyond this. Bandura (1986) provides the concept of vicarious consequences. Jane is quite possibly experiencing routine positive vicarious consequences from being in repeated close proximity to the technologically-proficient teachers. She sees them being successful with the CMC technologies and observes their positive affect, which she then transfers to perceptions of her own behavior that further encourages her use of the technologies.

Following from the proceeding discussion, the nonfictional educational story seems to be a valid and useful tool for increasing knowledge of teachers' experiences, perceptions, and feelings in regards to CMC technology use in the classroom. Indeed, bringing to light and sharing the variety and myriad of views, considerations, rationales, and decision-making processes about CMC technologies that reside in the minds of teachers provide a way to gain understanding of teachers as a full individuals. Additionally, as the knowledge sought and the method employed are epistemologically and inexorably intertwined, it is necessary for the researcher to concurrently reflect on the nonfictional educational story as both a means and an end. As an end, it provides an understanding of the teacher; as a means it provides a mechanism to better understand one's own teaching practices (Clandinin & Connelly, 1989). Thus, the nonfictional educational story holds great promise in increasing the understanding of what it means to be a teacher who either potentially or actually uses CMC technology in the classroom.

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An Investigation of the Influence of Computer Technologies on Teaching and Learning as Perceived by Students and School Personnel in Selected Public Secondary Schools in Wyoming

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Abstract: This paper is a report on a naturalistic study involving students and their teachers in secondary schools in Wyoming. Students and teachers in six randomly selected high schools were interviewed on-site. Students reported that word-processing was the most common application used at school. Their favorite activity was accessing the INTERNET. Students emphasized heavily that teachers should allow students to use computers more often, allow more freedom in using computer technology, and that schools should provide more computers and computer courses and provide more opportunities for computer access at evenings as well as during the school day. They emphasized that computers allowed more exploring, more independence, and more fun in learning than when it was teacher directed. Teachers were mixed in their opinions. Most welcomed the changes in student- directed learning and expressed desire to continue to learn how to integrate these technologies effectively while a few expressed concern with computers promoting weaknesses such as in spelling, writing, and mental discipline for learning.

Background and Rationale

Since 1986, public school personnel throughout the state have been encouraged to integrate computer technology in the classroom. The State Department of Education mandated a computer aided instruction in-service course as part of teacher recertification requirements. For example, The Wyoming State Technology Plan (September, 1997) has within its long-range objectives the need to establish and evaluate integrated technology practices within the public schools. School districts have requested numerous university sponsored extension courses involving new instructional technologies. Almost every district-sponsored staff development plan included some form of teacher in-service for integrating computer technology in the classroom. During this same timeframe, the College of Education implemented computer technology course requirements as part of the undergraduate teacher education program. It is unclear as to what degree schools in Wyoming have integrated computer technologies into their classrooms. Also, it is not known as to whether the College of Education is providing the appropriate support to facilitate the integration of computer technologies in public schools. Other states have begun similar investigations to determine the status of this technology integration such as the effort just begun in Missouri (University of Missouri, 1998).

Computer technologies have been hailed as the most likely innovation to effect change in the public schools (Connick & Russo, 1995). The ability to access information from world-wide sources (Leu, etal, 1997), create simulations with three dimensional effects, manipulate graphic animations and sound, without the need for programming skills on low-cost desktop and laptop computers has unleashed a power to learners that require teachers to relinquish the role of provider of all information. Someone was once quoted as saying "Overhead projectors were used in bowling alleys for 35 years before they were commonly used in the classroom". It is hoped that computer technology integration is occurring at a better rate than what happened for the overhead projector.

It has been suggested that the role of the teacher in the classroom must change as computer technologies are integrated in the classroom (Bielefeldt, 1997, Plater, 1995, Rowe, 1993). Emphasis has been placed on the teacher as accepting a facilitative role in guiding students through information access and processing, problem-solving, and creative learning projects on the computer in a student-centered classroom rather than the traditional image as the presenter in front of the class. It has also been suggested that teacher-student interaction can be more electronic, such as email, during times other than the official school day similar to the techniques employed in distance education (Lehman, 1995).

Teachers who have effectively integrated these technologies in their classrooms have reported higher levels of motivation, interest in learning, increased problem-solving skills, and improved achievement by the students (Mingus & Grassl, 1997, Rowe, 1993, Sawyer, 1994). Based upon efforts in in-service activities with teachers in Wyoming, primarily at the elementary school level, it was a natural question to ask if the same motivation level and interest was occurring at the secondary level as well, or whether the integration of computer technologies had occurred successfully in the 9-12 classrooms.

Objectives of the Study

The intent was to determine the answers to the following questions:

1. What types and levels of computer technologies are being used by students and teachers?
2. What effect, if any, have computer technologies had on teaching and learning practices in schools?
3. What practices have been successful in promoting successful adoption of computer technologies in schools?
4. Have computer technologies changed the way teachers teach and students learn?

Procedure

A naturalistic inquiry approach was used to conduct the study. This approach was selected in order to facilitate on-site observations while schools were in session and to enable unpredicted answers to be followed by additional inquiry during the interviews (Lincoln & Guba, 1985). Selected high schools in Wyoming were contacted requesting permission by the researcher to visit during the Fall, 1998. During the visit, permission was obtained to visit students in classes, study halls, and computer labs to determine their perceptions to the four questions listed above. They were also asked to complete a brief questionnaire to determine the frequency and level of computer technology used in school. In conducting the interviews, I excused the teacher for 20-30 minutes to take a break while I talked to the students. The students enjoyed the fact that a professor from the university was willing to listen to their opinions. In all cases, the students began talking freely. Several teachers in small groups, technology directors, and school principals were interviewed and asked the same questions as those asked of the students. The data collected from subjects included field notes taken by the researcher during the interviews. Pilot test results were used to refine the list of interview questions prior to the interviews.

After refinement, the following open-ended questions were developed for structuring the interviews with both students and teachers:

3. What computer applications do you use at school?
4. Do computer technologies help you learn? If so, how?
5. In what ways do your teachers use computers either for homework assignments or in teaching
6. What has your school done to help make use of computers possible? Do they need to do more?
7. Do you learn differently because of computers? Do teachers need to change the way they teach because of computers?

Results

The intent of the first interview question was to determine the level of technology used in schools. It was overwhelming to note the consistency in responses by both students and teachers in using word processing the most, followed by INTERNET information searching. The use of multimedia was extremely limited unless the student was in a class designed for learning those techniques. Drawing/drafting was mentioned by a few students enrolled in those technology-specific classes. One art teacher, however, described at great length how her students use web pages to analyze the different types of art, shapes, use of color, and texture in daily classes on the subject. One teacher, responsible for yearbook production, listed almost every application available on the server in the school as technology she taught her students to use in the production of the annual.

In response to the second question, students immediately focused on the power of information access from INTERNET. They also liked the way computer technologies allowed them to work at their own pace. Several students expressed higher interest levels because computers allowed them to be more creative and " make learning

more like exploring". They preferred that teachers allow them to find information using computers rather than lecture. However, in response to a follow-up question, most all students quickly expressed the need for the teacher to be present to assist them in dealing with frustrations, and providing guidance to help insure success in accomplishing the task at hand.

Most students think that teachers use only word processing and gradebook software. Almost none reported such uses as presentation technology, field data collection, simulations, or illustration purposes. Most teachers interviewed supported the students' perceptions. A few teachers, however, described heavy uses of the INTERNET to update their instructional material. Three math and science teachers described how they used programmable hand-held calculators to collect and graph field data from research conducted during out-of-classroom laboratory sessions. It was interesting but not explained why students didn't mention these applications.

In response to question four, most students were fairly positive toward the school's efforts. They did have some good solutions to suggest in solving what seemed to be the common problem, computer access. They complained that computer labs were always tied up by scheduled classes and there was no place else to go. Several students suggested that labs be open more often at night for student use. Several students expressed frustration with the school's reluctance to trust them with INTERNET and email. In one school, for example, the policy is to issue email addresses and privileges to all students who achieve a 3.0 grade point average or better. Those students who had not earned the privilege understood the reason but still expressed dissatisfaction in being in the 'have-nots' group. In regard to being able to do homework on computers, one student offered an innovative solution; have laptop computers to check out from the library just like books. One student suggested that the school rent computers just like the video stores rent out VCRs and movies. These ideas surfaced in two different schools visited.

Most teachers were happy with the efforts made for hardware acquisition but expressed the need for more applicable software for their respective subject areas. They spent most of the time responding to this question by expressing serious frustration with the lack of quality in-service and technical support. In-service appears to follow the typical model, "too much tell about it with not enough 'hands-on' training". In one school however, where the approach has been to train the teacher to teach peers in the building, most teachers stated positive thoughts about the technical support and in-service provided.

Question five elicited most interesting ideas from the students. Most students first began with the fun that computers provided, that learning at their own pace was most ideal, and that computers allowed for more exploring. They also liked the fact that work was easily redone when mistakes were found. One student talked at great length about how computers allowed her to explore instead of just perform only routine tasks. Students thought teachers should relax more about computer technology and admit when they didn't know how to use some applications. One student said, "I would like to teach them (teachers) how to capture 'cool stuff' from the INTERNET". Students thought that teachers overused computers in some classes (i.e. English) but not enough in others. Several students spoke out strongly about some traditional roles that teachers should still do such as present information that is hard to find and help students more with difficult assignments and problems. Only one student expressed this thought, "Teachers should disappear and let me learn all I need to know on the computer."

Most teachers responded positively to changes that computer technologies may bring about. Most expressed gratitude for the ability to assign their students to search for information on the INTERNET and know that something would be found. Some teachers expressed desire to integrate computer technologies more if someone would show them what is available, appropriate, and how to use it. One math teacher expressed how the technology allowed him to focus on the exciting real-life problems rather than the laborious arithmetic functions that took all his time before. An art teacher said the only thing holding her back was more computers in her room. Two young teachers said they would hesitate a long time to consider leaving to another school because of the strong technology support where they were. A few teachers did express concerns about traditional learning skills such as spelling and handwriting that they thought may be weakened by the use of computers, however the debate that ensued indicated there was not general agreement on this issue. One teacher asked, "When do we say we have changed enough?"

Implications

It was most interesting to hear how many students in the various schools expressed the keen interest that computers and connectivity through INTERNET and email provides. One student explained, "Using the INTERNET is like exploring; that's why it's so much fun". It was amazing to hear how many students saw computer technologies as a way to learn on their own. They expressed a concern that many teachers maintain the image that they cannot use any technology they don't understand how to use themselves. One student said, "they should let us teach them how to use the computers". It was obvious from students' comments that teachers must be

more student-centered in their approach and use computer technology to put fun, creativity, and independent responsibility as well as academic challenge back into learning. The message to teachers was rather clear as well, the primary item being, to lose their fears about not knowing everything and to give students the opportunity to show what they know. Teachers should feel a great deal of pride in knowing that students value their primary function as facilitator and mentor rather than the source of all knowledge.

By determining the degree to which the integration of computer technology has occurred in schools, we now better understand how to prepare teachers to teach in a way that takes advantage of this technology. Students and school personnel are benefiting from this project in several ways. By reflecting on the computer technology in their lives at school and in the future, they are discussing how they can be more effective in its integration. Teachers were also relieved to hear that students overwhelmingly still expressed the need for teachers' presence and interaction to effectively learn from computers. Teachers were curious to hear how most students described the desirable teacher-student interaction as facilitative rather than directed instruction. A better understanding of how computer technology should be integrated into pre-service and in-service teacher education will also benefit faculty at the university as well.

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Identifying Cognitive Dissonance Prior to Technology Integration

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Abstract: This study was designed to identify cognitive dissonance in teachers prior to any major technology integration initiative. A pre-inservice questionnaire was developed for teachers based on the principals used in art-therapy and traditional forms of survey development. The questionnaire consisted of 20 questions and was administered to 30 elementary teachers. Teachers responded positively to the direct questions about technology integration. Asking the teachers to draw how they felt towards computers in their classrooms provided important information about teacher's attitudes that were often not articulated because of perceived expectations for computer competency.

Introduction

This study was designed to measure teacher attitudes towards computers and identify cognitive dissonance in teachers prior to any major technology integration initiative. Cognitive dissonance is one factor which often undermines technology integration and is seldom accounted for in the planning stages of such an initiative. Amico (1995) discusses the importance of offering technology inservice at appropriate levels of skill and interest to enhance technology integration but does not mention any attempts to measure cognitive dissonance directly. Researchers take a variety of approaches to enhance technology integration, from categorizing teachers, setting standards, to lists of do's and don'ts (Beasley & Sutton, 1993; Friske et al, 1996; Hawkins, 1994; Bits, 1991). When teachers cognitively believe that computers should be an important part of education but have deep seated personal reservations about their ability to control their classrooms and the technology, cognitive dissonance occurs. Until the disparity between what teachers think and how they feel about computers in their classroom is dealt with, technology integration can never hope to be more than mildly successful.

Teachers often vocalize the perceived importance of the technology. Many want their students to be exposed to the myriad of computer-based instruction now available but do not have either the technical skills or the classroom integration skills necessary to be successful. Identifying cognitive dissonance in teachers prior to technology integration allows for change agents at the school and district level to probe for clarification as to the cause of the dissonance. Technical skills is usually the first deficit to be considered and is the most time consuming to remedy (Amico, 1995; Ingram, 1994; Mead et al, 1991).

Models for classroom integration are generally new and not well tested and evaluated but should also be considered in teacher training as examples of best practice to date. These can be formalized models like Bell's "High Technology Model" or it can be short presentations by master teachers who have been successful in integrating technology. Practical methods and activity-suggestions go a long way to alleviating teacher anxiety and reducing cognitive dissonance (Bailey & Bailey, 1994).

Asking the teachers to draw how they feel towards computers in their classrooms provided important information about teachers attitudes that we believe are often not divulged. Art therapists use drawing as a method to help people connect to their emotions. Knowing how teachers feel personally about the technology they have available to them should determine the kinds of training and support they receive. Identifying cognitive dissonance in teachers prior to beginning any technology integration initiative allows for the inclusion of appropriate instruction and increased awareness of potential weak points in the integration strategy.

Methods

A pre-inservice questionnaire was developed for teachers loosely based on the principals used in art-therapy and traditional survey development theory. A fundamental premise of art therapy is that the expression of creating art connects with feelings that you may not be aware of. Moon (1994) contends that art-therapy is effective with a wide range of individuals for differing backgrounds. He also maintains that "artistic expression is a healthy act" which helps individuals to connect to their feelings (76).

The questionnaire consisted of 20 questions and was given to 30 elementary teachers who were expecting to have to integrate technology into their classrooms in the near future. It was anticipated that each classroom would get 8-10 computers, a printer, and a modem for use throughout the school day. The change in classroom environment was anticipated to have a profound affect on both the teachers and their students.

Teachers were required to first draw how they viewed themselves in relation to the anticipated integration of computers into their classrooms and then write how they felt. The drawing question followed guidelines given by Oster & Montgomery (1996) and Brooke (1996). After drawing a representation of how they felt in the box provided, teachers were asked to respond to a traditional series of direct questions about technology in schools.

The degree of cognitive dissonance was determined by comparing the number of positive and negative responses to the direct questions to the degree of positive and negative emotion displayed in their drawing. Degree of positive and negative emotion in the drawing was determined by a cognitive dissonance rubric.

Results

A detailed discussion of the results of this research can be found with their supporting tables at the following URL, as they were not available at the time of the paper submission. The authors apologize for any inconvenience to the reader. Updates presented at the conference will also be available from this URL. http://mse.byu.edu/ipt/students/ruttan/cognitivediss.html

Conclusion

Teachers responded positively to the direct questions about technology integration. However, many teachers have personal concerns about their ability to manage technology in their classrooms that they are reluctant to articulate, as evidenced by their drawings. Therefore we can conclude that what teachers say in relation to the merit of technology in schools is not always indicative of how they really feel about technology in their own classroom.

Asking the teachers to draw how they felt towards computers in their classrooms provided important information about teacher's attitudes that are often not divulged because of perceived expectations for computer competency. Knowing how teachers feel personally about the technology they have available to them should determine the kinds of training and support they receive. Identifying cognitive dissonance in

teachers prior to beginning any technology integration initiative allows for the inclusion of appropriate instruction and increased awareness of potential weak points in the integration strategy.

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Collaborative Research Partners: Technology Integration Model that Supports Learning Communities

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Abstract: This research project examines an innovative technology integration model that includes the design, development, implementation and assessment of the use and integration of technology by inservice and preservice teachers. Personnel from a school district, an area education agency, and a college of education work collaboratively to provide the support and resources that are necessary to facilitate the exemplary use and integration of technology in elementary classrooms. The proposed three-year model provides a framework that will establish mentoring relationships between preservice and inservice teachers and will create classroom opportunities for them to infuse technology with best teaching practices. This paper will describe the purpose of the project and will discuss various activities that have occurred during the first year of the project.

Introduction

"....what teachers actually need is in-depth, sustained assistance as they work to integrate computer use into the curriculum and confront the tension between traditional methods of instruction and new pedagogic methods that make extensive use of technology" (Panel on Educational Technology, 1997, p. 49).

For years, schools have purchased large amounts of technology in hopes that students and teachers a like would use these cognitive tools to help facilitate the teaching and learning processes. Despite this huge investment, few of the nation's teachers actually use technology in their teaching (Office of Technology Assessment, 1995). Although technology access has improved, teachers have been given little support in their efforts to use and integrate technology in their classrooms (Office of Technology Assessment, 1995; Panel on Educational Technology, 1997; Sheingold & Hadley, 1990). It is a difficult task for most teachers because not only do they have to learn how to use the technologies, but also they may have to change the way they teach. Still, helping teachers use technology may be the most important task for helping students use technology effectively for learning (Office of Technology Assessment, 1995). Inservice teachers are not the only educators who are not supported in technology use. Preservice teachers who graduate from teacher education programs must be prepared to use and integrate technology when they enter classrooms as well.

Several have suggested that colleges and universities must take a leadership role in preparing preservice teachers to use and integrate computer-related technology in schools (Espinoza & McKinzie, 1994; Office of Technology Assessment, 1995). Preservice teacher education programs can significantly impact future K-12 computer-related technology use by effectively preparing teachers who have the knowledge and the ability to use and integrate computer-related technology to enhance teaching and learning (Berney, 1991). Teacher education faculty, like their K-12 colleagues, face many of the same barriers such as limited access, little knowledge of technologies, and limited time. Before technology use and integration throughout teacher preparation programs can be realized, teacher education faculty and preservice teachers must receive substantial amounts of training and support in developing effective classroom strategies and applications of technology.

The potential use of instructional technology to improve teaching and learning in K-12 schools is great, yet it has been problematic because typically, inservice and preservice teachers have not been given the time nor the opportunity to learn how to use and integrate these technologies throughout the K-12 curriculum (Office of Technology Assessment, 1995). For this research project, a technology integration model is being developed that provides inservice and preservice teachers the on-site support they need to use technology to impact K-6 student learning. The strength of the model exists in the fact that it brings together the efforts of personnel from three educational institutions which are actively involved in providing support for the exemplary use of technology in Iowa schools: a school district, an area education agency, and a college of education.

Background

The following three sections provide a literature based rationale for the need to support inservice and preservice teachers in their use and integration of instructional technology. The three areas reviewed include: 1) technology integration models, 2) technology support for inservice teachers, and 3) technology in teacher education.

Technology Integration Models

Potentially, technology has the ability to change the way teachers teach and students learn. New ways of teaching and learning have emerged as educators explore the many possibilities technology affords learners in classrooms. Several researchers have developed models that describe the stages educators progress through as they learn how to use and integrate technology (Dwyer, Ringstaff, Sandholtz & Apple Computer, Inc., 1990; Office of Technology Assessment, 1995).

Researchers involved with the Apple Classroom of Tomorrow (ACOT) program identified five stages of evolution for technology use in classrooms (Dwyer, Ringstaff, Sandholtz & Apple Computer, Inc., 1990). This research contributes to the growing body of evidence that "teachers' beliefs about instruction and schools is an important factor that underlies the institution's resistance to change" (Dwyer, Ringstaff, Sandholtz & Apple Computer, Inc., 1990, p.15).

The five stages that comprise the ACOT model of technology use include: Entry, Adoption, Adaptation, Appropriation, and Invention. The entry stage refers to the teachers' experience level with the

technology when they began the project. Once teachers accommodated the technology in their classroom to support their traditional methods and materials, they are at the adoption stage of technology use. During the adaptation stage teachers used various technologies as productivity tools in their classrooms and discovered students could use these cognitive tools for higher-order learning and problem solving. At the appropriation stage, teachers thoroughly understood technology as they began to emphasize project-base learning in a supportive, collaborative and interdisciplinary classroom. At the final stage, invention, teachers begin to invent new learning environments that use technologies as flexible learning tools. These learning environments become constructivist in nature as learners construct their own knowledge rather than receive it from someone else. This notable research helps other educators realize the time it takes for teachers to use and integrate technology successfully in classrooms and identifies various stages K-12 teachers progress through when using technology with students.

In the report, *Teachers & Technology: Making the Connection*, three levels of technology use in teacher education are identified: 1) discussion/demonstration, 2) technology practice, and 3) professional practice (Office of Technology Assessment, 1995). The order of these levels suggests a developmental model of technology use in teacher education; the progression through which preservice teachers are guided to acquire basic skills as well as sophisticated models of technology integration for classrooms. At the discussion/demonstration level, a professor might discuss how to use a database in an elementary classroom to an entire class of preservice teachers. The second level of technology use, technology practice, provides preservice teachers with hands-on technology practice. For example, preservice teachers in a reading methods course might spend time in a computer lab reviewing and examining several elementary word processing programs. Viewed as the most complex level of technology use in teacher education, the professional practice level focuses on integration of technology into K-12 classrooms. At this level, preservice teachers are either observing technology-based learning in K-12 classrooms, designing lesson plans that integrate technology, or teaching with technology in K-12 classrooms. Ultimately, preservice teachers design curriculum materials that infuse technology and practice teaching with technology in classrooms.

Technology Support for Inservice Teachers

There are not enough teachers in the K-12 schools who have acquired the necessary computer skills to utilize technology for classroom instruction (Office of Technology Assessment, 1995). Some reasons for the shortage of teachers who are capable of using instructional technology include the lack of technology courses offered in teacher training institutions, the inability of economically pressed school districts to hire new teachers with computer experience, and inadequate technology staff development programs (Office of Technology Assessment, 1988, 1995).

National surveys have been conducted to determine if computer inservice education and staff development programs are available for teachers. Data from the report, *Teachers and Technology: Making the Connection*, suggested that K-12 teachers still have very little training available for them to learn about technology and its education uses (Office of Technology Assessment, 1995). Less than half of the respondents reported having computer courses available for their teachers either at the district or local college level. Findings from this study indicated that more resources had been allocated to purchase hardware (55%) and software (30%) than were allocated to provide training and support (15%) for teachers. Respondents noted that most of the computer inservice training sessions for teachers focused on learning about computers, not on learning how to teach with the technology. This study indicated that teachers perceive the most effective staff development programs were ones that include follow-up support after the initial training.

Under the direction of the President's Committee of Advisors on Science and Technology, the Panel on Educational Technology (1997) was given the task to provide the President with advise on the application of instructional technologies in K-12 schools in the United States. The panel reported that K-12 teachers receive little technical, pedagogic or administrative support for using technology in their classrooms as of 1997. This report indicates that only 15% of a school's typical technology budget is used for professional development, rather than the recommended 30% that is considered by most to be the minimum.

While K-12 schools and school districts continue to plan for technology use and integration, teacher education institutions typically have not done the same (Schrum, 1994). Little has been done by most teacher education institutions to help faculty use instructional technology or to prepare preservice teachers who are capable of using technology in classrooms.

Technology in Teacher Education

Several teacher education institutions identified the need to improve upon their efforts to promote the use and integration of instructional technology by teacher education faculty and students (Kortecamp & Croninger, 1994). Preservice teachers enter schools inadequately prepared to integrate technology effectively into their teaching repertoires (Davis, 1994). It is evident that many preservice teachers feel they lack the necessary skills and experiences to use technology for teaching and learning. In fact, not only must preservice teachers understand the potential of technology, they must understand how to use technology in the classroom with students (Barron & Goldman, 1994). To develop this vision, preservice teachers must have educational experiences that model how instructional technology can be used for instruction and as learning tools throughout their preparation program (Byrum & Cashman, 1993).

Many of the challenges that teacher education faculty members encounter in their attempts to use and integrate technology are similar to barriers K-12 teachers experience. Teacher education faculty stated they lack the necessary time to become more knowledgeable about instructional technology (Office of Technology Assessment, 1995). Teacher education faculty can be certain that learning how to use and integrate technology will take time, as it will probably be several years before they are comfortable using these technologies with students in their courses. As noted by Becker (1994) and Sheingold and Hadley (1990), if often takes K-12 teachers more than five years to become accomplished computer-using teachers.

Description and Implementation of the Project

As recommended by the Panel on Educational Technology there is a need to conduct "early-stage research aimed at developing innovative approaches to the application of technology in education...." (Panel on Educational Technology, 1997, p. 124). This research project examines an innovative approach to technology integration in a school district that includes representatives from a number of educational institutions involved in the systemic change process for school improvement. One goal of this project is to provide a framework that can be duplicated or modified by other school districts or teacher education institutions where educators work collaboratively to assist preservice and inservice teachers in their efforts to design compelling uses of technology that will facilitate meaningful learning in classrooms. This innovative model provides a means to which there is a shared responsibility of providing the necessary support and resources to increase the exemplary use of technology in schools.

The educational institutions involved with this collaborative project include a school district, an area education agency and a college of education. North Polk Community School District includes four small towns and the surrounding rural area and serves approximately 900 students. Heartland Area Education Agency (AEA) is a regional service center that serves 56 public school districts, 35 approved non-public districts, 120,531 students and 9,031 certified staff members in an eleven county area. An instructional technology team that consists of five members provides leadership and expertise in educational technology at the local, state and national level. The Department of Curriculum and Instruction in the College of Education at Iowa State University (ISU) prepares 1025 undergraduate elementary education majors and 500 undergraduate secondary education majors. The undergraduate and graduate instructional technology programs in the Department of Curriculum and Instruction have traditionally been known for preparing preservice and inservice teachers to use computer-related technology for learning and teaching.

Plans and preparations for this project began with meetings and discussions between key personnel from North Polk, AEA, and ISU in 1997, but the actual research project and related activities began in September of 1998. Project activities that have been implemented during the first year of the project include the selection of project participants, the collection and analysis of first year data, and the design and delivery of professional development activities.

Project Participants

Both inservice and preservice teachers volunteered to participate in this three-year research project. Inservice teachers from the North Polk school district expressed that they viewed this as an opportunity to

mentor preservice teachers on best teaching practices while receiving support in their use and integration of technology. Nineteen teachers representing various grade levels and specialty areas from two K-6 elementary buildings are participating in the project. In addition, ISU preservice teachers are excited to have the opportunity to share their working knowledge of information technology with an experienced teacher and to participate in a number of classroom-based learning experiences while completing their degree. Sixteen preservice teachers who are majoring in elementary education, secondary education or early childhood education are participating in the project. The majority of these preservice teachers will have completed the required introductory instructional technology course, will complete their freshman or sophomore year this spring and will pursue a minor in educational computing offered by the Department of Curriculum and Instruction at Iowa State University.

Collection and Analysis of Data

Since this research project is in the initial stages of implementation the data analysis and findings will not be reported in this paper. Data will be collected throughout this project to monitor the progress of participants in learning to use and integrate technology in classrooms. Several of the methods used to collect data include participant interviews and focus groups, direct observations and questionnaires.

Professional Development Activities

Participants involved in this three-year research project will be introduced to a framework that provides them with support and hands-on experiences using technology to enhance the instructional goals of their classrooms. Within this framework, various professional development activities will be introduced and implemented at various times each year. These activities will include technology and curriculum inservices, a preservice/inservice teacher mentoring program, courses, focus groups, and classroom support experiences. The project members who are responsible for the design and delivery of the professional development activities include two instructional technology consultants from the AEA and a professor and a graduate student from ISU. In addition, preservice and inservice teachers will be more involved in the delivery of the professional development activities as the project evolves over time.

The professional development activities that have taken place during this past fall semester were primarily designed for the teachers at North Polk. The majority of the teachers in this school district have had little experience using technology in the classroom, so the professional development team designed and scheduled activities that would provide support for the teachers in a variety of ways. During the first semester of the project the professional development opportunities have focused on introducing teachers to email and one-computer classroom approaches to using technology with students.

Although the North Polk teachers have had access to email in their schools, the electronic mail system they were using was not considered to be user-friendly by many. One of the AEA instructional technology consultants worked with both the district and elementary technology coordinators to set-up and install QuickMail for all elementary teachers. Then, the AEA technology consultant met with each teacher individually during the school day to provide him/her with the instructions on how to use the new email system. The AEA consultant continues to follow up this introductory session with weekly email messages to the teachers that provide them with additional instructions that help them use other features of the email system.

Since the focus of the project is to improve the use and integration of technology in classrooms, significant time has been spent designing professional development activities that will assist teachers in their use of technology in classrooms. To accommodate teachers' schedules, several approaches have been used to deliver these staff development activities. District administrators gave teachers the opportunity to participate in whole group inservices during district inservice days. This semester, the purpose of the whole group inservices was to introduce teachers to one-computer classroom software. Following these inservices, teachers could sign up to have one of the professional development team members come into their classroom to teach a lesson using one of the software programs introduced during the whole group inservices. To participate in this classroom activity, teachers had to verify that the software used and lesson created supported grade level curriculum initiatives. Then, a professional development team member went into the classroom and taught the lesson with assistance from the classroom teacher. In most cases, the teacher was then responsible to continue

or follow up the initial lesson with activities of their own. These classroom team-teaching activities were highly successful and will be continued throughout the project as more software programs are introduced.

As this project moves into its second semester of implementation the preservice teachers will play a major role in supporting the teachers as both discover ways to integrate technology into teaching and learning environments. To meet a university field experience requirement, each ISU preservice teacher will spend approximately 2-4 hours per week in a classroom with a North Polk teacher. Specific course activities are being planned for the preservice teachers as they participate in this field experience with teachers. Preservice teachers will also be encouraged to participate in the technology inservices that will be offered next semester.

Other professional development activities are being planned for spring semester and beyond. There will be a two-day workshop for participants (i.e., inservice & preservice teachers) this summer. Next fall, inservice and preservice teachers will be taking a three-credit university course in which they will learn and support each other as they continue to explore the possibilities of using technology in elementary classrooms.

Summary

This project is the result of collaborative planning efforts by administrators and teachers from a school district, instructional technology consultants from an area education agency, and faculty and preservice teachers from a university. The major goal of this technology integration model is to create a community of learners where all participants share their knowledge and expertise with each other to ultimately improve the learning process for elementary students.

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The Relationship between Cognitive Strategy Use and Students' Hypermedia Navigation

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Abstract: Hypermedia applications provide a new approach to education and present another advancement for student knowledge building; however, little research has been done to investigate how students interact psychologically with this new medium. As hypermedia becomes a more common instructional format, researchers need to anticipate the difficulty students will encounter while working in this new environment. Applying the conceptual frameworks and findings from strategic learning research in traditional learning environments to the research in hypermedia learning environments should be helpful in preparing students to work effectively and efficiently in hypermedia learning environments. This study compares one aspect of strategic learning, students' reported use of cognitive strategies in traditional environments, with the students' hypermedia navigation. It is anticipated that the use of cognitive strategies may mediate the relationship between hypermedia navigation and achievement.

Statement of the Problem

As technology has transformed home and office environments, it also has the opportunity to enhance the educational system. A shift is occurring in both teaching and learning because students are spending so much more time working with computers. Unfortunately, the advancements in technology are outpacing the advancements in our understanding of the psychological aspects of working with computers. This is a particular problem for instructional psychologists. Researchers do not fully understand how students interact with computer-learning environments and as a result we cannot determine which types of instructional design methods could improve the learning process and make it more effective and efficient for the students. This type of research is not only important for K-12 or college-level students, but also for continuing education and training in business and industry. Thus, there is a tremendous need for applying educational psychology theories to instructional technology research.

Current Instructional Technology Research

The use of hypermedia learning environments in education has not fulfilled the expectations of many instructional technology researchers. Three major assumptions have guided recent hypermedia investigations: (a) the node and link structure of hypermedia corresponds to the associative nature of the human mind; (b) the non-linear format of hypermedia forces learners to take an active role, thus promoting self-regulated, constructivist learning; and (c) the use of multimedia corresponds with the cognitive principle of utilizing multiple modes of representation to enhance learning and memory. However, the empirical results of these investigations have not supported these assumptions (Tergan, 1997). Rather than the design of the hypermedia programs promoting more active learning, it is becoming apparent that the learner's characteristics are interacting with the design characteristics to result in various levels of performance. In addition to the structure of the hypermedia program, the cognitive activities of the learners themselves also seem to be a significant factor in determining achievement (e.g., Dee-Lucas & Larkin, 1995; Lee & Leeman, 1993).

One of the often cited benefits of the use of hypermedia in instruction is the ability to incorporate additional resources, such as databases, glossaries, video clips, search engines, etc. However, students will not automatically use the computer facilities in an optimal manner simply because the tools are available (McKnight, Dillon, & Richardson, 1990; Tergan, 1997). Rouet and Levonen note that students have not had the chance to develop effective strategies for working with hypermedia (1996). Reading traditional printed text requires a significant amount of practice and refinement of specific strategies. These strategies are usually dependent on familiar text

structures. Hypermedia represents an unfamiliar text structure to which students must adapt their traditional reading methods. In this new non-linear environment, students must keep track of where they are and where they want to go while building a mental organization of the material they are encountering (Rouet & Levonen, 1996). Certainly the research on cognitive strategies may be applied to the hypermedia learning environment in order to improve the quality of learning while working with a computer system. The students must possess the requisite knowledge of how to use the system effectively in relation to their own learning goals. This requires that the students must be "strategic learners," or students who know about themselves as learners, who are aware of the task characteristics, and who can implement the necessary skills to reach their learning goal.

It is also becoming apparent that the research on learning with hypermedia needs to be based on a theoretical framework (Astleitner, 1997). Performance cannot be attributed solely to characteristics of the hypermedia learning environment. Rather it is the result of a complex interaction of the learner variables, instructional methods, task characteristics, and attributes of the media (Tergan, 1997). Future research must take these variables into account to more fully understand the nature of learning and instruction with hypermedia programs.

Applying Strategic Learning to Hypermedia

One well-developed area of educational psychology is strategic learning research. Educational psychologists describe strategic learners, or self-regulated learners, as learners who are behaviorally, motivationally, and metacognitively active participants in their own learning (Zimmerman, 1986). Learners can influence how they process incoming information, and in turn to what degree they actually "learn" the information and transform it into organized knowledge (Weinstein, 1994; Weinstein & Mayer, 1986). In contrast to how learners are depicted in behavioral theories, the cognitively-active learner is not a passive respondent to environmental conditions or demands. Individuals can take specific steps to effectively evaluate, integrate, analyze, and retain new knowledge.

Hypermedia applications provide a new approach to education and present another advancement for student knowledge building; however, little research has been done to investigate how students interact psychologically with this new medium. As hypermedia becomes a more common instructional format, researchers need to anticipate the difficulty students will encounter while working in this medium. Applying the conceptual frameworks and findings from strategic learning research in traditional learning environments to the research in hypermedia learning environments should be helpful in preparing students to work effectively and efficiently in hypermedia learning environments.

Weinstein has developed a Model of Strategic Learning which is composed of three distinct components: Skill, Will, and Self-regulation (Weinstein, 1994). The Skill component consists of five basic categories of knowledge that strategic learners possess: (a) knowledge of themselves as learners; (b) knowledge about different types of academic tasks; (c) knowledge about strategies and tactics for acquiring, integrating, applying, and thinking about new learning; (d) prior content knowledge; and (e) knowledge of both present and future contexts in which the knowledge could be useful. The Will component consists of the affective aspects of the learners, such as their motivation, academic goals, beliefs, and volition. The Self-regulation component consists of things such as the metacognitive awareness and control of the learners, their execution of time management skills, and their execution of systematic planning skills. The Skill, Will, and Self-regulation components surround the core of the model, which represents the individual learner's long-term goals and his/her general self-system variables, such as self-concept, self-expectations, and self-efficacy. For learners to reach an academic goal, they must have the necessary skills, motivation, and self-regulatory processes.

Self-regulated, or student-directed, learning has been termed the highest form of cognitive engagement (Corno & Mandinach, 1983), yet many students have difficulty adjusting to a self-regulated environment because they lack the effective strategies necessary to succeed (McCombs, 1988). Hypermedia educational programs can provide powerful environments for student-directed strategic learning. "Users with the abilities to select information, make connections with existing knowledge, organize their approach to accomplishing tasks, and monitor the process will be those who can perform effectively in the type of self-regulated environment of a hypermedia system" (Gay, Trumbull, & Mazur, 1991). However, this claim has not been investigated adequately by researchers.

My dissertation research will examine the relationship among all of the components of the Model of Strategic Learning and students' hypermedia navigation. However, the most important variable for this paper is the knowledge and use of learning strategies. Learning or cognitive strategies are defined as "behaviors and thoughts that a learner engages in during learning that are intended to influence the learner's encoding process" (Weinstein &

Mayer, 1986, p. 315). The use of these strategies allows the learner to become an active participant in the learning process rather than passively receiving the information. Weinstein and Mayer (1986) outline the three major categories of learning strategies: Rehearsal, Elaboration, and Organizational. Rehearsal strategies are most useful for basic memorization of facts or ideas. Examples of rehearsal strategies include mnemonics and highlighting. Organizational strategies help the learner structure the material in a more personally relevant fashion. Examples of organizational strategies include diagramming and outlining. The goal of elaboration strategies is to transform the incoming information and make it more relevant by integrating it with the student's prior knowledge. Examples of elaboration strategies include summarizing and paraphrasing. Organizational and elaboration strategies require deeper processing and generally result in more long-term learning.

Research has consistently shown that the knowledge and use of cognitive strategies is associated with increased levels of performance (Pintrich & Garcia, 1993; Weinstein & Mayer, 1986; Zimmerman & Martinez-Pons, 1990). The use of cognitive strategies facilitates the encoding of information and aids in the subsequent retrieval of information. Current studies have suggested that students who use cognitive strategies in traditional environments will generally be able to regulate themselves in a learner-controlled computer environment (much like hypermedia) more effectively than students who do not use cognitive strategies in traditional environments (Young, 1996).

Research Study

Approximately 360 students enrolled in a first-year, first-semester French course are currently participating in the study. The students meet once a week in the computer lab to work with a hypermedia CD-ROM, *Parallèles Interactive.* The students' navigational trails while working with the program are automatically logged by the computer.

The final data will be collected at the end of the Fall, 1998 semester. Cluster analysis will be performed on the students' log files to examine patterns of individual differences based upon the computer features accessed by the students. The log files will be coded according to: time on task; frequency of accessing nodes containing either grammar, lexical, or cultural information; listening to full-length audio; listening to line-by-line audio; accessing the dictionary; answering the comprehension questions; and accessing the Internet. Patterns relating to achievement across clusters and patterns relating to achievement within clusters will be examined. For example, one possibility across clusters could be high achieving students will use more of the computer features whereas low achieving students will not use as many features. The higher achieving students may recognize the benefit of using more of the supports whereas the low achieving students may not. Within a cluster, it may be that some students do not use a lot of the supports and still score higher in achievement, whereas other students who did not use a lot of supports scored lower in achievement. It is expected that the students' reported use of learning strategies will mediate this relationship. The high achieving students may use the computer features strategically in order to accomplish their task and in turn earn higher grades, while the low achieving students who also access the same features do not use the features strategically.

Students' reported use of cognitive strategies will be measured by the Rehearsal, Elaboration, and Organization subscales of the Motivated Strategies for Learning Questionnaire (MSLQ). Achievement will be measured by chapter exam grades. At the time of this writing, the data collection was in process. The paper presentation will describe the actual data analyses. The various navigational profiles as well as the profiles' relationships with achievement and reported use of cognitive strategies will also be discussed. If the hypothesis of this research is supported, it will yield support for the importance of considering instructional design in relation to the students' individual differences with respect to strategic learning. Although instructional designers may include tools to aid students in their learning, the students may not use the tools effectively because they do not know *how* to use them.

Summary

I believe applying the findings of strategic learning research in traditional environments to instructional technology research will give us a more complete picture of what characteristics students bring to the learning situation and how these variables may impact the use of a hypermedia program. Specifically, the use of cognitive strategies may mediate the relationship between hypermedia navigation and achievement. As more options are added to hypermedia programs, people need to understand how to work with the medium more. We need studies in

applied research to examine the relationship between the various strategic learning variables and students' interactions with hypermedia learning environments. The results from these studies should help instructional designers improve the content of the hypermedia programs as well as help students to interact with the programs more effectively.

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Formative Evaluation of a Multimedia Case: A Test of Practice

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Abstract: This paper reports about a formative evaluation of a multimedia case for elementary science teacher education. This case has been developed in the framework of the MUST project. The formative evaluation had the form of two micro-evaluations with prospective teachers. These teachers are the primary target group of MUST products. Besides a conformation of our general ideas and design, the evaluation results provide many suggestions for improvement both at the interface and technical level as well as at the more basic educational level.

Introduction

The central theme of this paper is the formative evaluation of the multimedia case "Liquids in test tubes". This case has been developed in the framework of the MUST project. The acronym MUST stands for MUltimedia in Science and Technology. The main aim of the project is to develop and to evaluate multimedia cases for elementary teacher education in the Netherlands. The multimedia case that is central in this paper contains the following components: video of a lesson, comments on the lesson, background information of the school, curriculum information, lesson plans, specific information about the science content of the lesson, learning tasks, and an orientation on the program.

In the first section of this paper the design of the formative evaluation is presented. Subsequently, an overview of the results is given. Finally, the conclusions and decisions for improvement of the prototype are presented.

Design of Formative Evaluation

The overall design of the formative evaluation consists of three stages: micro-evaluations, try-outs and effect studies. In this paper the focus is on micro-evaluations. In a micro-evaluation a limited number of members of the target population (i.e. prospective teachers) uses the program. The evaluations were guided by three main questions:

- How do respondents perceive the usefulness of the different components of the multimedia case?
- How easy to use is the interface?
- What is the opinion about the educational value of multimedia cases in teacher education?

In the two micro-evaluations the 10 respondents combined two roles: the role of a learner and the role of a reviewer (cf. Nieveen 1997). Data were collected by means of questionnaires, observations, interviews and analysis of assignments.

Summary of Results

Perception of Different Components of the Multimedia Case

The core of the multimedia case is a non-scripted 17-minute *video of a lesson* about liquids in which the learning cycle of elementary science teaching is applied. All 10 respondents agreed that such a video is an important

and enjoyable component of the multimedia case. As expected they were, compared to the other components, most positive about this part of the multimedia case.

The multimedia case also includes *comments on the video-lesson* from the video-teacher, experts in the field (two teacher educators and a curriculum specialist) and two prospective teachers. The aim of the comments is to warrant different perspectives on the lesson. In general, the respondents valued this part of the CD-ROM. However, the evaluation results revealed some interesting differences between respondents. Firstly, some respondents tend to value the comments of the experts as more worthwhile than the other comments. According to them: "You learn most of those comments." However, one respondent expressed an opposite opinion: "The comments of experts are dull, it is like listening to a textbook".

Another, non-anticipated, result appeared from the evaluation. Some respondents who saw "their teacher educator" on the CD-ROM ignored the comments of other experts. They seem to think that it is most important to know what your teacher educator says about the video clip of the lesson. Students who did not have the opportunity to consult the comments of their teacher educator gave equal attention to all comments, and elaborated on the differences between them.

There were also differences in the appreciation of the comments of fellow prospective teachers on the CD-ROM. Some respondents enjoyed these comments very much, while others mentioned that comments of fellows are not very useful. One respondent stated: "You cannot learn very much of those comments".

The *background information of the school* where the video was recorded (including information about the teacher and the students) was valued, but the respondents ask for more focused information. General information, such as hobbies of the video-teacher, was regarded as superfluous. However, according to the respondents, more information should be added about the teachers' vision on elementary science and about the way he teaches science in his classroom. The respondents would also appreciate more information about the students of the class.

The components *curriculum information, lesson plans and specific information about the science content of the lesson* were regarded as useful, although the way the information was presented (text) could be more attractive. Moreover, respondents would like to obtain more in-depth information about the science content of the lesson.

Two comprehensive *learning tasks* were added to the multimedia case. Respondents perceived these tasks as useful, because it helps them to give focused attention to the information in the case. However, they also perceived these tasks as rather difficult and made suggestions to improve them. An analysis of the way they conduct the learning tasks revealed that the respondents could make a rather elaborate analysis of the lesson and could relate the information in the case to their own experience. However, it seems quite complicated for them to formulate precisely what they would do differently, when they were asked to implement lessons of this kind themselves.

The *orientation on the program* was meant as an introduction and as a means to motivate students. However, it did not serve its purpose. Some respondents doubted whether such orientation is necessary, because the program is clear and motivating enough. Others, however, recognized the potential value of an orientation, but suggested redesigning it.

Practicality of User-interface of the Multimedia Case

Most respondents perceived the user-interface as comfortable to handle. Especially inexperienced computer users were pleased that they could easily find most information. More experienced computer users expressed some critical comments on the interface, they thought the two different ways to navigate are unnecessary redundant.

The most critical problem with the interface was the filing of information users could actively add such as their completion of the learning tasks. It was very difficult, especially for the inexperienced users to find the files back in their computer system.

The CD-ROM ran smoothly on the rather sophisticated computer networks of teacher education colleges, but when some respondents played the CD-ROM on their home computers, it turned out that the program did not run very well on older computers.

Overall, the evaluation of the user-interface also provided detailed information for debugging and other minor suggestions for improvement.

Educational Value of the Multimedia Case

After working with the CD-ROM, eight out of ten respondents were convinced of the educational value of the multimedia case. The reasons why can be summarized as follows:

- it illustrates and provides a clear impression of the difficulties of elementary science teaching;
- it allows for exploring questions about elementary science teaching;
- it is motivating to work in such a different way.

One of the two respondents who had doubts about the usefulness of the multimedia case had severe technical difficulties with the user-interface, and the other did not like the topic of the video-lesson at all. Moreover, the latter student experienced difficulties with the language level of some parts of the multimedia case, since Dutch was not her mother tongue.

Conclusions and Recommendations

The first question of the formative evaluation of the multimedia case "Liquids in test tubes" was about the appreciation of the different components of the multimedia case. Overall, all components were rated positively by the prospective teachers, but the evaluation revealed also many interesting suggestions for improvement.

As far as the component *comments* is concerned, an idea for improvement is to communicate to the users clearly that especially the differences in comments are meant to be a source for reflection and learning. Discussing the evaluation results with regard to the comments-page in the MUST team, also led to modifications of the comments. We decided to highlight the differences between the comments more clearly, and to reduce the number of persons who give comments from six to four. The latter was done, because, on some aspects, the comments had quite a lot in common. This redundancy is not stimulating for users to analyze the information.

Although the *background information about the school* (including teacher and students) was regarded as useful, the evaluation results give reasons for major improvements. Prospective teachers want more focused information and additional information about especially the teacher and the students. Although, it is not possible to collect this information for the prototype under evaluation (because for budget reasons we used an already existing video of 1993), in the next MUST productions this information will be far more elaborated. Amongst others, much more student work will be included in further multimedia cases. Within the MUST team, there has been a discussion about the ethical aspect of including personal information about students in a multimedia case. The conclusion of this discussion was that for privacy reasons we do not include, for example, test scores or opinions of the teacher of individual students. Instead, we asked students to give some personal information and to give their opinion of elementary science, themselves. The students were also invited to present themselves by their Christian name only. Moreover, all student work that is directly related to the videotape will be included in further cases.

Based on the evaluation results, the decision was made to make the *curriculum information, lesson plans and science content information* more attractive. This will be done by a more appealing presentation of textual information. Moreover, the science content will also be presented by means of instructive computer animations.

The *learning tasks* on the CD-ROM caused, from a technical perspective, major problems. This was one of the reasons to exclude learning tasks from the next version of the CD-ROM. In addition, a more important reason for this decision has been our growing insight that predefining learning tasks is not in line with the "flexibility in use" rationale of the MUST project. Therefore we decided to opt for a web-based interactive database that contains a variety of learning tasks (for more details see paper of Nieveen & van den Berg, 1999 in this SITE conference).

The *orientation* on the multimedia case was not appealing to the users, therefore we completely redesigned it.

The second question concerned the user-interface of the multimedia case. Although it was easy to handle, the user-interface has been redesigned as well. This was mainly a consequence of the necessary modifications following from other evaluation results and was also based on suggestions gathered during an expert appraisal. Because users were not completely comfortable with the navigation options in the first prototype a navigation option has been included in the revised version that makes short cuts possible. Moreover, explicit system specifications will accompany the second prototype.

The third question was how prospective teachers would perceive its educational value. The results show that a fast majority of the respondents was positive about this educational value. However, a minority did not share this opinion. From their comments we gained two ideas for improving the prototype. Firstly, the filing system of the learning tasks should become user-friendlier and the language level of the learning tasks should become less complicated, especially for prospective teachers who are of non-Dutch origin.

In sum, we may say that the micro-evaluations with a limited number of potential users provide many ideas to improve our product. We learned once again that these kinds of small-scale evaluation are very informative and cost-effective.

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Evaluating NCATE Technology Standards Implementation in a School of Education

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Abstract: This article describes the process of a school of education in its early stages of technology planning that entails: the development of a technology integration task force; the evaluation of current faculty levels of technology proficiency, integration, and implementation of the NCATE technology standards within the SUNY Oswego School of Education; and the development of recommendations for a long range technology plan. Sixty-five full time education faculty members were administered two surveys through campus mail. Results (N=45) revealed that moderate to high levels of faculty proficiency and integration were limited to the areas of word processing, email and Internet related activities. The leading predictor of implementation of NCATE standards was not overall proficiency of computer hardware/applications but proficiency in instructional methods of technology integration. Recommendations for long range planning address equipment, faculty training, as well as programmatic changes.

Introduction

In the last eight years, the National Council for Accreditation of Teacher Education (NCATE) in conjunction with the International Society for Technology in Education (ISTE) has developed several sets of guidelines and standards to strengthen the support for technology use and integration in professional teacher preparation programs. While each set of standards has provided further guidance to improving teacher education programs, each set has also called for a deeper commitment toward the infusion of technology by schools, colleges, and departments of education (SCDEs).

The first set of guidelines was released by ISTE in 1991 and established technology standards for all teachers. Adopted by NCATE and utilized in the accreditation process, these thirteen technology competencies not only set a benchmark for all current teachers but also a guide for teacher education programs across the nation (Thomas 1991). In response to these standards, several SCDEs have required preservice teachers to attend a course(s) on educational technology and to then demonstrate technology competencies prior to graduation (Hess, 1992). Although a technology-specific course develops basic computer skills, several studies have concluded that a stand-alone course does not prepare educators to utilize technology in a variety of instructional settings (Handler & Pigott 1994; Office of Technology Assessment 1995; Wetzel 1993).

In 1994, NCATE and ISTE set forth accreditation guidelines that focused more on the integration of technology in professional teacher preparation programs. These guidelines require teacher candidates to complete a sequence of courses/experiences to develop an understanding of the impact of technology on schools and to use of technology in instruction and assessment and for professional productivity. In addition, these guidelines require that education faculty be knowledgeable about current practice related to computer use as well as integrate technology in their teaching and scholarship. As SCDEs have developed training programs for faculty to facilitate the infusion of technology within the education curriculum, many SCDEs have encountered several obstacles, such as a lack of faculty interest, information, expertise, time, equipment, and software (Parker 1996; Wetzel 1993). However, in an attempt to overcome these obstacles while creating technology-using educators, many SCDEs are developing comprehensive technology plans that encompass equipment needs, student and faculty technology proficiencies, as well as course and programmatic changes. Such long range plans have spawned the creation of many innovative strategies and programs as well as the evaluation of such plans.

While several SCDEs have developed and implemented technology plans, other SCDEs are just beginning to address the problem of technology integration. However, since the 1997 recommendation from the NCATE Task Force on Technology and Teacher Education that requires accredited SCDEs to develop and implement a plan for technology, more SCDEs are initiating the technology planning process. This article describes the process of a school of education in its early stages of technology planning.

Methodology

The Process

When I arrived as a new faculty member in the department of curriculum and instruction at SUNY Oswego in 1996, the school of education (SOE) had just developed an educational technology course and was in the process of developing a new education computer lab. Unfortunately, most preservice teacher education students were not receiving any instruction on computer applications or integration methods since this newly developed technology course was not a program requirement and conflicted with most required courses. In addition, education students were experiencing few computer-related activities in their education courses due to a lack of equipment and faculty expertise. Frustrated with the lack of technology resources available as well as the lack of technology skills among education faculty and students, I proposed to the Dean of Education that a technology task force be developed to assess the school's current technology use and to create a long term plan for technology integration. Since the school was seeking NCATE accreditation, the Dean believed that data generated from the task force would not only assist the NCATE process but also address a concern that had been repeatedly expressed by area superintendents—that education graduates are not prepared to integrate technology in the classroom. The Dean forwarded the proposal to the SOE's faculty council, which approved the creation of a technology task force in November of 1997 and outlined its charge as the following:

- define technology;
- develop a snapshot of where the SOE is presently in terms of faculty skill/comfort levels in using technology, availability of technology to faculty and students, and level of faculty integration in education courses;
- conduct a review of the literature that includes an examination of what other schools of education are doing to increase technology integration; and
- develop recommendations for a long-range technology plan.

The task force was asked to complete its work by April 15 and met several times to create a plan, collect and review data, and develop recommendations. All six department chairs were asked to appoint at least one department representative; however, individuals from only five departments either volunteered or were appointed for a total of seven members. During its first meeting on January 30, the task force developed a plan of action by accomplishing the following: elected a chair, reviewed task force objectives, defined technology, identified methods of data collection, decided to elicit student assistance in conducting a literature review on technology integration in schools of education, reviewed and developed survey instruments, determined a time line to satisfy the SOE deadline of April 15; and scheduled additional meetings for data review and discussion. The task force's definition of technology would be that of educational technology, which would encompass computer technology and applications. The task force determined that two surveys would be administered to measure faculty technology proficiency, integration of applications, perceived barriers to technology integration, training preferences, and NCATE implementation.

Participants

Of the 65 full time faculty members in the school of education, 45 completed both evaluation surveys. A full time faculty member was defined as being a full-time instructor or tenure-track faculty. Approximately 90% of the SOE faculty were Caucasian. Response rates and percents for each of the SOE departments were: counseling and psychological services (n=9, 81.8%), curriculum & instruction (n=15, 68.1%), educational administration (n=3, 100%), health, physical education, & athletics (n=5, 45.5%), technology (n=8, 66.7%), and vocational technology education (n=3, 60%). All respondents reported having a computer at home, while only 95.3% reported having an office computer. Unfortunately, only half of the respondents reported having an office computer with adequate memory, hardware, and software.

Instrumentation

Two surveys were developed for this evaluation: SOE Technology Integration Survey (SOETIS) and the NCATE Implementation Survey (NIS). The SOETIS consisted of 32 items that had been adapted from a survey developed by the author the previous year for a Goals 2000 grant (Vannatta & Reinhart, 1998). The revised survey measured five areas: background information, proficiency in computer equipment and applications, integration of technology in education courses, factors that impede technology integration, and training preferences. Background information, such as department membership, type of computer at home and office, platform preference, and access to computer lab for student instruction, was addressed in the first six items. Items 7 - 27 asked faculty to identify current proficiency using computer equipment, applications, and instructional methods for integrating technology. These 21 items utilized a Likert scale of 1-4 in which 1 represented no proficiency. Item 28 asked faculty to

identify, from a list of fifteen computer applications/activities, which specific activities were currently being integrated in their education courses. In this item, participants distinguished between faculty demonstration/use and student use by writing "p" for professor use, "s" for student use, and "ps" for use by both. Faculty also identified factors that were perceived as impeding their technology integration, as measured by item 29. From a list of thirteen possible factors, faculty ranked the top three barriers most encountered when using or trying to use computer technology in instruction. The next two items addressed faculty preferences for future training topics and format. Faculty ranked the top five topics for future faculty training on technology (Item 30). Rankings were made from a list of seventeen topics. Item 31 asked faculty to indicate a format preference for future training. Format options were: two hour training sessions; half day training workshops; peer mentor program, in which a skilled colleague would work with a faculty member; and student-faculty mentor program, in which a trained student would work with a faculty member. Although technology training, usually in two hour blocks, had been offered to faculty for years by the university and most recently in the department of curriculum and instruction, these sessions were not regularly attended. Therefore, the task force was particularly interested in determining if alternative training formats would be well-received. The final SOETIS item asked faculty to provide any comments regarding technology integration. Comments were to be written on a separate piece of paper and attached to the survey. SOETIS item responses were analyzed for reliability using Cronbach alpha and were determined to be reliable ($r = .8203$).

The other survey developed for this evaluation was the NCATE Implementation Survey (NIS). This survey asked faculty to identify which of the 13 NCATE technology standards were being implemented in specific education courses. Each faculty member listed courses that he/she instructed and checked the standards that were being implemented in each course. NIS responses were also analyzed for reliability using Cronbach alpha and were determined to be reliable ($r = .9356$). Both surveys were administered to all SOE faculty via campus mail. The two surveys were sent out in the month of February. A reminder along with the necessary instrument(s) were sent to faculty in March. By April 1, 45 faculty members had returned both surveys.

Results

Technology proficiency varied among faculty. The greatest percent of faculty reporting moderate to high proficiency were in the areas of: general computer use (90.7%), word processing (93%), and email (92.8%). Only 40.4% of faculty members indicated moderate to high proficiency in instructional methods for integrating technology. In terms of computer applications being integrated into education courses, 75.6% of faculty reported having both students and self utilize word processing in courses. Other applications used by both faculty and students in courses were email (62.2%) and Internet (48.9%). Implementation of NCATE technology standards was primarily limited to standards that address computer use to access information, enhance productivity, and utilize software (See Table 1). Specifically, Standard 12—Use computer-based technologies to access information to enhance personal and professional productivity—was implemented by 71.1% of faculty in one or more classes,

	In at least 1 or more courses		In all courses	
	n	%	n	%
Standard 1	28	62.1	20	44.4
Standard 2	20	44.3	13	28.9
Standard 3	17	37.7	7	15.6
Standard 4	23	51.2	8	17.8
Standard 5	24	53.4	9	20.0
Standard 6	17	37.6	5	11.1
Standard 7	17	37.6	6	13.3
Standard 8	16	35.4	5	11.1
Standard 9	26	57.7	19	42.2
Standard 10	16	35.4	8	17.7
Standard 11	21	46.5	10	22.2
Standard 12	32	71.1	22	48.9
Standard 13	19	42.1	8	17.8

Table 1: Percent of faculty addressing NCATE technology integration standards in their education courses.

while 48.9% implemented it in all courses taught. Standard 1—Operate a computer system in order to utilize software— was implemented by 62.1% of faculty in one or more courses and by 44.4% in all classes.

Surveys also elicited faculty responses regarding perceived barriers to integrating technology as well as training preferences. Faculty identified lack of equipment and lack of time to learn new technologies as leading barriers to integrating technology. Forty percent of the faculty identified instructional methods of integrating technology as their number one preference for future technology training. Faculty also indicated a desire to receive training on computer presentations. Preferences regarding training format were peer mentor program (42.2%) followed by two hour group sessions (31.1%), student-faculty mentor program (28.9%), and half day group sessions (11.1%).

Data were also analyzed to identify any predictors of technology integration in education courses. The following variables were utilized in this analysis:

- Overall technology proficiency—sum of proficiency in 21 areas from SOETIS Survey;
- Proficiency in instructional methods of integrating technology—Item 27 on SOETIS Survey;
- Integration of computer applications—sum of course integration of 15 computer applications from SOETIS Survey. Since faculty indicated the level of use as student, faculty, or both for each of the 15 applications, responses were assigned a numerical score as follows: student use=1, faculty use=1, both student and faculty use=3; and
- Implementation of NCATE technology standards—average number of standards implemented per course from NIS Survey.

The Pearson correlation matrix of these variables is presented in Table 2. Overall technology proficiency was not highly related to integration of computer applications (r=.3366) or to implementation of NCATE standards in education courses (r=.4694). However, proficiency in instructional methods of integration technology was fairly related to integration of computer applications (r=.5645) and implementation of NCATE Standards in education courses (r=.6057). These results lead the task force to conclude that faculty members do not need to be proficient in a variety of technology applications in order to integrate technology, rather they must be as proficient in a few computer applications and most importantly be knowledgeable in instructional methods of integrating technology in the classroom.

	Overall Proficiency	Proficiency in Inst. Methods	Integration of Comp. App.	NCATE Implementation
Overall Proficiency	*	0.7352	0.3366	0.4694
Proficiency in Inst. Methods	0.7352	*	0.5645	0.6057
Integration of Comp App.	0.3366	0.5645	*	0.7518
NCATE Implementation	0.4694	0.6057	0.7518	*

Table 2: Correlation matrix of technology proficiencies and integration.

Recommendations

Equipment

Although nearly 100% of all full-time SOE faculty reported having an office computer, only half had a computer that was even capable of connection to the new campus network and has a CD-ROM and adequate memory for running up-to-date software. Consequently, many faculty were limited to the computer applications of old equipment—word processing and email. In addition, faculty identified lack of equipment as the number one barrier to technology integration. Upon reviewing this situation and recognizing that many other institutions have found it necessary to develop equipment standards (Northrup & Little, 1996), the task force provided its first recommendations.

Recommendation #1—Develop a standard for all future SOE computer purchases, such as requiring a CD-ROM and high memory. This standard should be revised annually to accommodate the increasing demands of software.

Recommendation #2—Develop a plan to replace low performing office computers on an ongoing basis. Faculty cannot increase their skills until they have the equipment to do so.

It was also determined that very few departments have computer equipment that can be used in the classroom. Although computer labs are available for classroom use on a reservation basis, an entire lab is not always necessary. Much of the time, faculty and students are in need of a computer and an LCD projector for presentation and/or demonstration purposes.

Recommendation #3—Provide each department with a portable presentation unit (laptop computer and portable LCD projector). Ideally several classrooms should be permanently furnished with such equipment.

Faculty Technology Proficiency and Integration

SOE faculty were most proficient and most frequently integrating word processing, email, and the Internet in their courses. An interesting finding regarding proficiency and integration was that overall technology proficiency was not a strong predictor of technology integration, rather feeling proficient in instructional methods of integration was more of a predictor. In addition, faculty (60%) overwhelmingly indicated that future training should focus on instructional methods of integrating technology. Consequently, the task force concluded that faculty training programs should not strive to develop a broad range of technology skills, but rather emphasize the facilitation of instructional methods for technology integration and the development of proficiency in a few personally selected areas of technology.

Recommendations regarding faculty training were guided by several other factors. The task force determined that a variety of training formats were essential to fulfill the many different preferences faculty reported. Consequently, the task force believed it necessary to continue large group training sessions in two-hour blocks but also to develop two new training programs that would fulfill the desire for one-on-one instruction as well as peer observation. Although faculty preferred the development of a Peer Mentor Program, the task force believed that this format was not feasible since the number of faculty able to provide one-on-one mentoring is minimal at this time. However, the task force did believe that a Peer Mentor Program could provide faculty with opportunities for peer observation, through which faculty would observe skilled faculty integrate technology in the appropriate field of instruction. Such a program would require fewer skilled faculty members. The task force asserted that the implementation of a Student-Faculty Mentor Program would fulfill the faculty desire for one-on-one technology training. Such a program has been implemented at Iowa State University and has been very successful in providing faculty members with one-on-one support and training as well as increasing their integration in education courses (Thompson, Hanson & Reinhart, 1996). This innovative training method utilizes undergraduate or graduate education students to mentor education faculty on computer use and integration techniques and is also is a requirement of students enrolled in an advanced educational technology course. Although SUNY Oswego does not currently have an advanced educational technology course, it is hoped that once the introductory course becomes a requirement in most education programs more students will have the skills to provide basic instruction to faculty as well as the interest to pursue additional courses in educational technology. Having reviewed several training options, the task force set forth the following.

Recommendation #4—Implement a variety of technology training programs that require faculty to establish technology goals for the each academic year.

- The Peer Mentor Program would arrange to have faculty observe other faculty who are effectively integrating technology in instruction.
- Student-Faculty Mentor Program would be attached to an advanced educational technology course in which students would be required to mentor a faculty member. Faculty members would volunteer to participate and would have to commit to meeting with their mentors an hour each week of the semester. This program would be similar to the one implemented at Iowa State University.
- 2 Hour Training Sessions would provide faculty with instructional methods of integrating technology.

Finally, although the primary objective of this task force was to develop a plan for increasing technology integration among education faculty, the underlying goal is to increase the technology proficiency among our education graduates. Many schools of education have established technology benchmarks/competencies for education graduates to provide accountability for programs, faculty, and students. Although NCATE has established technology standards for teachers, these standards do not take into account the unique role technology plays in each education department and program of study. Consequently, the task force recommends the following:

Recommendation #5—Encourage departments to identify appropriate benchmarks/competencies for

program graduates and to create a plan that will facilitate student achievement of competencies. Such a plan would include identification of required education courses that address technology proficiencies and how technology will be infused in these courses as well as an assessment plan for measuring competencies.

Summary

Since the 1997 recommendation from the NCATE Task Force on Technology and Teacher Education that would require accredited SCDEs to develop and implement a plan for technology, more SCDEs are initiating the technology planning process. This article described the process of a school of education in its early stages of technology planning. Although the previous recommendations require a great deal of effort on administrators and faculty, K-12 schools are demanding that our graduates be proficient in not only using technology but also teaching with technology. While technology courses can instruct students on technology skills, preservice teachers who do not have the opportunity to observe effective use of technology in the classroom and to use it under the guidance and facilitation of faculty instruction will likely graduate with limited professional skills and lack an understanding of using technology as a tool in education (Handler & Pigott, 1994).

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R2D2: A Constructivist/Interpretivist Instructional Design Model

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Abstract: Until recently the great majority of instructional design (ID) models have relied on behavioral and information processing theories (Dick, 1996). There is, however, a growing body of literature on the practice of instructional design from aconstructivist perspective (Winn, 1992). Much of this literature has emphasized the types of learning environments that can be developed such as anchored instruction or problem-based learning (Cognition and Technology Group at Vanderbilt, 1993; Wilson, 1996; Lin, Bransford, Hmelo, Kantor, Hickey, Secules, Petrosino, Goldman, and the Cognition and Technology Group at Vanderbilt, 1998; Reigeluth, 1996, 1997). In 1995 I described the first version of an instructional design model based on constructivist instructional and learning theories and aninterpretivist philosophy of science (Willis, 1995). It was developed during work at NASA's Johnson Space Center in Houston and at the Center for Information Technology in Education at the University of Houston. The model, named Recursive and Reflective Design and Development (R2D2), was one of the first to lay out in some detail an approach to creating instructional material that was based on constructivist theory. This paper, which is based on work at Iowa State University, describes a revision of the R2D2 model anddiscuss some of the practical issues involved in using an ID model.

An Overview of the Revised R2D2 Model

The original R2D2 model has gained some attention in the literature. It is now covered in a number of instructional technology courses around the country (e.g., Bell, 1997; Turner, 1997; Santa Fe College, 1997) and the developers of other C-ID models such as the Layers of Negotiation model (Cennamo, Abell, and Chung,1996), A-Maze (Bing, et al., 1997), and the Jigsaw ID model (Robinson, 1997) have cited R2D2 as one of the influences on their model.

R2D2 has also generated some criticism. Apparently because the 1995 paper on R2D2 challenged some of the long-held assumptions of traditional instructional design theory, Braden (1996) commented that the author was "much like an arrogant adolescent with a chip on his shoulder" (p. 19). For a more thoughtful comparison of the Dick and Carey ISD model and the R2D2 model by one of the creators of the ISD model see Dick (1996).

I have now had an opportunity to work on a number of projects, including several dissertation studies at the University of Houston, that used the R2D2 model. That experience, plus discussions with graduate students and colleagues, my own reflections, and the useful criticisms of designers such as Braden (1996) and Dick (1996), have all influenced the evolution of the R2D2 model.

General Principles Versus Detailed Steps

The R2D2 model is based on the assumption that general principles can guide us as we come to understand the specific context of design and deployment. Trying to follow detailed, specific rules of design is discouraged because each context is unique. There is no Platonic "ideal form" of ID that can be used as a guide in all situations. The best we can do is work from general principles and our base of experience. R2D2 is based on three "guiding principles" or, to use Winn's terminology, three "first order principles." They are Recursion, Reflection, and Participation, and flow naturally from constructivist theory.

Recursive (Iterative), Non-linear Design

Fundamentally, iteration is the process of developing all or part of the instructional material in a form that allows both users and experts to fully participate in the process of revision and reformulation. This may happen over and over again in a complex project. It may also happen at many levels. Members of the design team may initially look at little more than scribbles on a flip chart. More accurately they create the scribbles on the flip chart through collaborative development of the concept. Later they may go through a scenario that tells the story of how the material would be used in a class and revise their conceptions of what it is that they will create. Still later they might look at rough and then progressively more complete prototypes of the material. Finally, relatively finished alpha and beta versions of the material would be used.

The concept of recursion (iteration) that we have in mind here is more than simply giving end users a chance to "have their say" about a product. That level of recursion is in most ID models. Somewhere in the process formative evaluations generate data from end users. Revisions can then be based on that data. In my view, more formative evaluations throughout the design process is better than the one or two that are typical of ID. But recursion as I see it involves more than that. It involves

full participation in the process of instructional design (See Bodker, Gronbaek, and Kyng (1991) for an explanation of cooperative prototyping, a concept that reflects our view of recursion and participation).

Reflective Design

Reflection is perhaps the most difficult of the three basic principles of the R2D2 model to explain. The opposite approach, technical-rationality, is relatively easy to explain. "Technical rationality is an epistemology of practice derived from positivist philosophy, built into the very foundations of the modern research university" (Schon, 1987, p. 1). Good practice from this perspective thus involves carefully and precisely defining the problem and then applying clear, well-formed solutions derived from good research to solve the problem.

A reflective model of practice assumes that many, if not most, important problems in professional practice cannot be well-formed and solved with preformed solutions. In such a situation, "the terrain of professional practice, applied science and research-based technique occupy a critically important though limited territory, bounded on several sides by artistry. There are an art of problem framing, an art of implementation, and an art of improvisation, all necessary to mediate the use in practice of applied science and technique" (Schon, 1987, p. 13). Those arts, of problem framing, implementation, and improvisation, make up reflective practice. They are more artistic than scientific, and they call for thoughtful and careful attention to as well as understanding of the context in which the professional work occurs. Schon uses the terms reflection-in-action and reflection-on-action to refer to the type of thoughtful work in context that I believe should be an important principle in design work. Schon's books (1983, 1987) are excellent guides to reflective practice.

Participatory Design

Participatory design is one of the more controversial aspects of "alternative" ID models. Participatory design reflects a shift from the perspective that "the designer knows best" to one in which the designer is part of a team that, collectively, can accomplish much more when each person is a full participant instead of an object of study. In their classic and influential book, Participatory Design: Principles and Practices, Douglas Schuler and Aki Namoika (1993) describe participatory design as "a new approach towards computer systems design in which the people destined to use the system play a critical role in designing it" (p. xi). They contrast it with other ways of designing. "Participation stands in contrast to the cult of the specialist. In the specialist model, an expert is sought out. The question is presented to the Expert who will eventually produce the Answer. With this approach, those most affected by the conclusion must sit idly by, waiting patiently for enlightenment. PD, of course, demands active participation. PD, however, is not against expertise. There is no reason or motivation to belittle the role of expertise. Specialized training and experience, both technical and interpersonal, are important. In the participative model, however, this special expertise becomes yet another resource to be drawn on — not a source of unchallenged power and authority. A partnership between implementers and users must be formed and both must take responsibility for the success of the project" (p. xi-xii). That, in a nutshell, is the essence of participatory design.

R2D2: Procedures and Focal Points

We believe the three principles discussed in the previous section are the most important part of R2D2. In this section we will present an overview of the activities and procedures typical of design work based on R2D2 but we must emphasize that these are suggestions, guidelines, and ideas rather than "set in stone" procedures that "must" be followed. ID at this point is much more art than a science. And, it is much more art than it is the correct application of technical recipes that require you to match well-defined conditions to well-defined solutions. If someone followed the four principles discussed in the previous section but did not use the procedures described below, I would consider it to be more in the tradition of the R2D2 model than if someone followed the procedures but did not use the principles.

The three focal points of the R2D2 model are Define, Design and Development, and Dissemination. There are no obvious starting and ending points because the model assumes designers will work on all three aspects of the design process in an intermittent and recursive pattern that is neither predictable nor prescribable. The focal points are, in essence, a convenient way of organizing our thoughts about the work. The type of work a design team might participate in for each of the focal points is described in the following sections.

Define Focus

This approach eliminates all of the common "up front" activities of ISD : learner analysis, task and concept analysis, and creation of instructional objectives. The beginning of a project is probably the worst time to create specific, detailed objectives. Understanding will emerge across the design process and will be of much higher quality than information and perceptions gained by studying people and ideas at the very beginning.

This idea of letting understanding emerge is strongly supported by chaos theory as well as constructivist theory. You (1994) suggests that a complete analysis of task and learner performed prior to implementing instruction does not guarantee that either the task or the knowledge and skill of the learner are unchanging. "Thus, iteration of all ISD operations such as analysis, design, and evaluation at every step become imperative. . . . Further, no single ISD operation has preeminence over any other, for

each operation plays its own unique role and together they form the distinctive character of the whole" (You, 1994, p. 24-25). I could not say it any better.

In the revised R2D2 model the Define Focus has three activities, Creating and Supporting a Participatory Team, Progressive Problem Solution, and Developing Phronesis or Contextual Understanding. All three activities are important in the beginning of a design project, but they must be attended to across the entire process. They are part of the entire design process, not distinct activities that occur at the beginning of the work.

Creating and Supporting a Participatory Team

My (JW) experience, and the experience of my graduate students, suggests that this is one of the most difficult tasks facing a constructivist designer. Creating a team is not difficult. But supporting one, encouraging one, and facilitating participation is not easy. There are two basic ways of creating a team. One is to enlist the cooperation of a small group of individuals who represent different stakeholder groups such as teachers, students, graphic artists, designers, and so on. This team then constitutes the participatory group that takes the project from start to finish. We have found that this approach works well when the team members are all heavily invested in the project and have the time to participate. When some members are less invested, or when time and availability are a problem, this approach can be frustrating to all concerned because it is difficult to get full participation. The result can be a project that has a participatory team in name only. In fact, only one or two people may end up making all the decisions while the other team members do not provide significant input.

An alternative is to organize a small core team, perhaps only one or two people, and then involve different people at different points in the process. Regardless of the form the participatory team takes, it will require thoughtful support and careful arrangement of the opportunities to participate if the members are to do their best as collaborators. There are a number of examples of participatory design projects in the literature. Several are reported in the Schuler and Namioka (1993) book.

Progressive Problem Solution

It is an overgeneralization to say that traditional ID models break the general design problem down into pieces and then attack the pieces one at a time. But it is not too much of an overgeneralization. Objectives are defined and finished first, then the criterion referenced tests are written based on the objectives, and so on. This approach, which involves finishing each task completely before moving on to the next was termed the *stagewise* model by Barry Boehm (1995). Problems with the stagewise model led to the *waterfall model*. Water (completed tasks) flows out of one pool and into the next where it is used to complete the next task in the sequence. The waterfall model added a feedback loop at the end of each stage that involved getting feedback on the product of that stage and then revising it before passing the results to the next stage. Braden's (1996) ID model is probably the clearest example of a modern waterfall ID model. For a detailed analysis of the problems with waterfall models see Boehm (1995).

There is another way to think about the work of design. R2D2 views it as a process of progressively solving multiple problems in context. That is, "solutions" such as the set of objectives for a project progressively emerge across the entire design process instead of being completed early and then used to guide design and development work. The fuzzy objectives you begin with will influence your design and development work, but conversely, design and development will also influence the objectives. R2D2 views design work as a richly interactive process in which solutions emerge across a process in which work on many different parts of the whole influence each other (and the whole). It is, as You (1994) described it, an "open system" that assumes initial conceptions and frameworks will change and evolve across the process. The idea of progressively solving the problems of design is one of the most difficult for many designers to accept because it means they must keep the process open and accept the idea of making major changes even late in the process. Another C-ID model, Layers of Negotiation (Cennamo, Abell, and Chung (1996), another non-traditional ID model, the Layers of Necessity Model (Tessmer and Wedman, 1990), and Boehm's (1995) Spiral Model of Software Development and Enhancement also emphasize the emergent aspects of design. As Cennamo, Abell, and Chung put it "Whereas traditional instructional design models often include discrete stages of analysis, design, development and evaluation activities, . . . we addressed the question of design in a spiral fashion, progressing through a series of stages at one level, then spiraling back and adding more detail within . . . . Consistent with the holistic manner in which experienced designers often apply traditional models . . . we initially made decisions across stages based on the data that was relevant, then, as more information became apparent or relevant, we spiraled back and added more detail across stages" (p. 43).

Developing Phronesis: Contextual Understanding

Are most design contexts like other design contexts? That is, can we develop generalizations, or rules, that can be easily applied across different design projects? Many ISD models are based on the assumption that there is much that can be generalized and thus they emphasize commonalities across contexts. They are thus based on the idea that Plato's epistemic knowledge is the foundation for ID work. R2D2 and other C-ID are based on the assumption that there is much that is unique in each design context and thus a designer (as well as the other members of the design team) must have or develop a sophisticated understanding of the particular context in which design work will take place. Aristotle's type of practical, in context, knowledge, phronesis, is dominant here.

Developing phronesis can be done in many ways - via team members who are long-term participants in the setting where the ID product will be used, by working for some time in that environment, by regular observations and interviews in that

environment, and so on. Different design jobs will call for different approaches, but the core issue is that there is no such thing as a "general ID expert" who can take his or her skills from one setting to another and design well without understanding the context. A good example of the importance of understanding context is a case study reported by Thoresen (1991). The case concerns a project to make changes in the support software for a large hospital. Several attempts to make constructive changes actually created major problems for nursing supervisors because the prototype software did not fit their work patterns. However, because this group had input into the design and development process the problems were identified and changes made. The knowledge the nursing supervisors had, phronesis, is difficult, if not impossible, for external experts to know. It is only by being immersed in the context, or by involving people from that context in the design process, that it can be known and used.

Design and Develpment Focus

The R2D2 model does not separate design from development. They are integrated a ctivities in this model for a number of reasons that were detailed in the original article on R2D2 (Willis, 1995). Perhaps the most important reason for integrating these two activities is that the reasons for separating them in the first place were technical. In the past most development environments were not change friendly, but powerful authoring environments now make changes, even major ones, and revisions possible in a fraction of the time that was required in the older learning environments. The three activities in the revised model are Selection of a Development Environment, Collaborative Inquiry, and Product Design and Development.

Selection of a Development Environment

The development environment actually consists of two components: the tools of design and the process of design. Tools include everything from a flip chart to an $8000 computer-based authoring environment. The ***tools*** will vary radically from project to project, but three criteria for evaluating tools should always be kept in mind: power, flexibility, and accessibility. When graphics are being created Photoshop is one of the most powerful and flexible programs available today, but there are other programs with less power and more flexibility that are more accessible. The relative importance of each of these factors will vary from project to project, but all three will influence the way the team works and the quality of the final product.

The ***process of design*** can be thought of as having four levels: Component Design, Single Path Prototype, Alpha Version, and Beta Version. Of course, there is usually more than one single path prototype, alpha version, and beta version. Each is gradually revised and improved (or abandoned when it is necessary to start over from scratch). When revisions on the beta version of the material are complete you have Version 1.0.

There is some linearity to this part of the model because it is difficult to do a beta version before completing an alpha version. However, there is still quite a bit of flexibility. The team can, for example, decide what to develop more fully and what to leave in rough or even uncompleted form at each point in the process.

This way of thinking about the ID process - components, single path prototype, alpha version, and then beta version - has worked well for us. However, there are a number of other frameworks for thinking about process that would also be quite appropriate. Bodker, Gronbaek, and Kyng (1993), for example, describe an approach that includes four major phases. Digital Equipment Corporation's Michael Good (1991) uses another form of participatory design that has five phases. Nathaniel Borenstein (1991) details a sequence of software development that is quite similar to Good's approach. In his very readable book Borenstein divides development into three phases: definition, prototyping, production, and maintenance. Gitta Salomon (1991) describes yet another way of thinking about participatory design in her case study of the iterative design of an information kiosk. Salomon's iterations were across progressively improved prototypes of the final product, and she divides the work into three phases.

Collaborative Inquiry

This aspect of the R2D2 model has been one of the most difficult to name and explain. Heron (1996), in his book on collaborative inquiry defined it this way:

> Co-operative inquiry involves two or more people researching a topic through their own experience of it, using a series of cycles in which they move between this experience and reflecting together on it. Each person is co-subject in the experience phases and co-researcher in the reflection phases. (p. 1)

Heron's idea of cooperative inquiry captures precisely what I have in mind in the R2D2 ID model. Members of the team cooperatively research and reflect with an eye toward improving the material being developed. This process is continuous and begins when the idea of creating instructional material is first discussed. It continues through the entire design and development process. It is not something that is done at particular points in the process, it is a continuous, integrated process that often cannot be distinguished from other aspects of the work.

Those are the underlying assumptions of cooperative inquiry. The actual methodologi es of doing it are many and varied. In fact, many of the methods of traditional ISD models are quite suited to cooperative inquiry. The way the data is collected is often the same, but the way it is interpreted and understood is different. An excellent source of guidance on how to approach the process of collaborative inquiry is a chapter by Jeanette Blomberg, Jean Giacomi, Andrea Mosher, and Pat Swenton-Wall (1993) at Xerox Corporation. Their chapter, Ethnographic Field Methods and Their Relation to Design, presents a theoretical framework for conducting what I have called qualitative research as part of the design process.

Product Design and Development

In the original paper on the R2D2 model (Willis, 1995) the example was a piece of learner-centere d software and I (JW) proposed a simple categorical scheme for thinking about designing the various components of the software:
Surface Design - screen layout, typography, language, graphics, illustrations, sound.
Interface Design - look and feel, user interaction, help, support, navigation, metaphors.
Scenario - sequence of simulation options/choices, results.

This way of slicing up the product is not suited to the design of all types of instructional materials. Since 1994 we have used the R2D2 model to develop a wide range of educational materials, from video-cases to electronic books and web sites that are resources for instructional technology courses. I believe the R2D2 process of design can be used to create a variety of educational software. There is, however, a more serious issue involved in the way we think about the product. It relates to how broadly we define the term "instructional material." Many of the ID models in current use restrict the use of that term to a relatively narrow set of instructional materials that either deliver or support the delivery of what is generally termed direct instruction. Tutorials, drills, and some types of simulations are well known forms of direct instruction. In my opinion, if we limit the use of ID to forms of direct instruction, we make a serious mistake. I believe direct instruction will play a much smaller role in teaching and learning in the twenty-first century than it has in the twentieth century. In his proposal for a new paradigm for instructional theories Reigeluth (1997) suggests that we need broad theories,

> "not just in the cognitive domain, where we need theories for fostering understanding, building higher-order thinking skills, developing metacognitive skills, designing problem-based and interdisciplinary or thematic learning environments, and tailoring instructional guidance to specific content-area idiosyncrasies, but also in the affective domain, where we need guidance for developing what Daniel Coleman calls "emotional intelligence" and for what Thomas Lickona calls "character education," as well as how to develop attitudes and values and so forth. Instructional theory has been construed much too narrowly in the past" (p. 1).

Dissemination Focus

ISD models generally include four activities in their dissemination stage: summative evaluation, final packaging, diffusion, and adoption. With the exception of summative evaluation, the R2D2 model adopts a similar approach. However, the constructivist emphasis on the importance of context suggests that diffusion and adoption should not emphasize using material in the "right" way. Instead the focus should be on helping teachers and learners adapt the material to the local context and use it in ways that are appropriate to that context.

The other aspect of the dissemination focus, summative evaluation, requires some additional comment. In the R2D2 model, there are too many local, context-based variables in the use of any instructional package to make valid or "scientific" generalizations to other settings. A summative evaluation in the R2D2 model is much less ambitious. It is the story of what happens when the material is used in a particular context in a particular way with a particular group of learners. Such summative evaluations can be very helpful to others who are considering using the material, but other potential adopters must consider many variables before they decide that findings from a summative evaluation may also apply to their setting.

Summary and Conclusions

R2D2 is one of several ID models based on constructivist theory. It has been used primarily in academic and research contexts, but other, similar, models have been used widely in industrial design and software engineering for many years. The model we decide to use and the models we accept as appropriate for others to use are based on our beliefs, our experiences, and our perspectives about what design is. They are not, however, selected by any one on the basis of superior research or "solid theoretical foundations."

There is no research that conclusively (or even inconclusively) demonstrates that one family of ID models is the better choice (Dills & Rominowski, 1997). Design work is probably so complex and so context-dependent that it would be impossible to empirically test the usability of one design model versus others. We must, for the most part, fall back on Winn's first principles to guide us. Selecting an ID model is a rational, not an empirical process. That point is not always apparent to proponents of different models. There have been instances where students were discouraged from using the R2D2 model because it was not yet "proven". The plain fact is that no ID model is proven. We must fall back on "first principles" that derive from our theories to make choices. ID is thus a field with very little, if any, empirical research to guide our decision making, but it has an abundance of theoretical frameworks within which to make decisions. I believe the situation calls for considerable dialog and sharing both within and among proponents of different ID models and theoretical frameworks. When it is all said and done, none of us are very good at this, and we need all the help we can get.

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SCIENCE

Top 20 Collaborative Internet-based Science Projects of 1998: Characteristics and Comparisons to Exemplary Science Instruction

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Abstract: This paper utilizes the characteristics of model science instruction to identify exemplary Internet-based science collaborations. The filter for attaining "exemplary" status was based on state and national standards-generating initiatives and the corresponding implications for appropriate student activity in science classrooms. Twenty examples of on-line collaboration are identified, described and used as models that contain the basic components of effective on-line science collaboration. These models also serve to highlight ancillary features that make on-line collaborative investigations even more effective.

Introduction

Using the Internet as a tool to facilitate collaboration between schools for data-sharing investigations is a fairly recent phenomenon. During on-line collaborations, teachers and students complete science-related investigations using a process common to their on-line partners. The specifics and mechanics of this process greatly varies. Yet, the common core of the investigation and process contains similarities to exemplary science instruction.

Exemplary Science Instruction

First and foremost, science instruction, whether Internet-based or not, should provide opportunities for students to develop toward well-defined science goals and standards. These standards provide a vision and indicators for those involved in producing exemplary science instruction. National efforts such as Project 2061's Science For All Americans (1989) and Benchmarks for Scientific Literacy (1993), The National Science Standards (1996), and compatible, but, more local efforts, such as Wisconsin's Model Academic Standards for Science (1998) provide guidance and examples for science programs and teachers who in turn, provide science experiences to children. These efforts to define goals have made specific content objectives less elusive, and have aided to assist science educators to reach some consensus concerning general goals. In general, science teachers want science students to (Berg & Clough, 1991):

- Perceive science as a set of meaningful, interrelated concepts, rather than mastery of many insignificant isolated facts;
- Convey positive attitudes about science indicating that science is meaningful and useful to them;
- Convey an understanding of the nature of science;
- Identify and solve problems effectively;
- Understand the connection of science to their community and personal lives;
- Demonstrate an awareness of the importance of science in many careers;
- Work cooperatively with other students as well as independently;
- Demonstrate constructive creativity and curiosity;
- Access, retrieve, and use the existing body of scientific knowledge in the process of investigating science-related phenomena;
- Communicate effectively;
- Set goals, make decisions, and self evaluate, and;
- Demonstrate logical as well as critical thinking.

During this enterprise, students should:

- Actively construct knowledge from what they observe and experience during the science activities;
- Ask questions, test ideas, interpret data, gather information, challenge ideas, physically and mentally manipulate objects and experiences;
- Actively participate in science;
- Identify problems as well as solve problems;
- Make decisions related to their science study and their science activities;
- View the classroom as a place to *begin* science-related inquiries; understanding that in-class experiences can be transferred to investigations *outside* of the classroom;
- View science as having intricate connections to their daily lives;
- Develop oral and written communication skills to display understandings of the fundamentals of science; and
- Use their scientific knowledge.

It is through this lens that we examined Internet-based collaborations to determine which might be used as models of exemplary Internet-based science instruction.

Exemplary Collaborative Inquiry

For this paper, collaborative inquiry is defined as one classroom interacting with one or more classrooms based on a science-related investigation or topic. Collaborative inquiry, while facilitating and including many of the goals listed above, may be accomplished several different ways. For example, while much can be accomplished using only e-mail and attachments, the advent of the web with graphics, sound, and forms to facilitate instruction has made the process of displaying information and interacting with others much easier and less technically demanding. Many projects are now based from web home pages and contain more user - friendly methods of sharing data via forms on the web page. Participants simply need to input data directly into the form, as opposed to sending additional e-mail attachments. The frustration of encoding and uncoding formats properly has been eliminated through the development of data forms which are inserted directly into the web site text. In addition, project proposers and organizers are somewhat savy to the necessary ingredients of a successful collaborative project. Their invitation to participate delineates the key foundational components needed to ensure a successful collaboration. The introduction tends to incorporate most of Harris' (1995) suggestions - the what, why, when and how so that potential collaborators know what is expected of them, as well as the potential benefits of joining the project. In addition, most home pages provide mechanisms for:

- project registration (via e-mail or web-based form)
- sending the collected data and receiving other participant's data (e-mail or web-site form, automatically re-sent to participants via e-mail reflectors, or stored on web site for participants to analyze).

In addition, web project pages might offer other necessary or sometimes ancillary components such as:

- Resource/related links
- A description of the experiment via text, movies or photos
- Talk to a scientist
- Archived data from past years investigations
- Real time images
- Project activities (classroom activities that extend the investigation)
- Student's projects such as artwork, writing, reports, publications
- Teacher's manual containing background information plus connections to science education standards
- Student-student or teacher-teacher interaction area: might be listserv, listserv archives, or a forum area
- Participant list with e-mail addresses
- Project-related news and announcements

While few, if any, of the projects selected contain all of the mechanisms and supporting features listed above, the projects highlighted in this paper represent collaborations that have great potential for appropriate science instruction due to both the similarity to exemplary science and the superior project planning and manner in which the project is supported, processed, and assisted by using the Internet.

Categories and Model Collaboration Examples

For the purposes of this paper, the model collaborative Internet-based science investigations located were separated into the following categories:

1. Observation and sampling of wildlife (self-collected data)
2. Observation and sampling of wildlife (scientist-collected data)
3. Observation and sampling of self-characteristics
4. Sampling and analysis of environmental data
5. Resource awareness and consumption
6. Content-related, participant-dependent calculations
7. Problem solving and engineering

While the categories are not entirely discrete, they serve to help delineate some aspects of participation or focus of the investigation. What follows is a listing of the Internet-based projects that we offer as model or exemplary projects.

Wildlife Observation/Self Collected

Bird Watch at Feeders: http://earth.simmons.edu/birdwatch_protocol.html
Enables students to study the various migration tendencies and behaviors of birds. An inquiry based learning experience correlated with the arrival of different species of birds. Integration of disciplines such as mathematics, geography and industrial technology.

The Vernal Pool: http://earth.simmons.edu/vernal/pool/vernal_1.htm
Students collect data while investigating plant and animal species that inhabit an actual vernal pool. Participants post interesting findings on the Vernal Pool listserv.

Road Kill 98 Dr. Splatt: http://earth.simmons.edu/roadkill/rk_protocol.html
Students predict animal species which are most often killed by motor vehicles. Discussions of various habitats as well as the ecological importance of wildlife are explored. Estimation, mapping and graphing skills are required of the students.

Plants – Ethnobotany: http://earth.simmons.edu/plants/plants_protocol.html
A monitoring project which enables students to discover learning about plants from a nontraditional perspective. Students gather biochemical and genetic characteristics of plants in an attempt to either confirm or deny existing information about the plant. Nutrition, bio-chemistry, conservation, and multicultural studies are easily incorporated into this project.

View Nesting Birds: http://www.pitt.edu/~dziadosz/
This web site contains many sites from around the world that provide live video and/or update photographs of a pair of nesting birds. Some birds are tracked by satellite as they migrate from their nesting area.

Wildlife Observations/Scientist Collected

Biological Timing Online Science Experiment: http://www.cbt.virginia.edu/Olh/
Students make hypothesis about the behaviors of hamsters. Live images and actual experiment results are shared with other scientists from around the world.

Journey North Tulips: http://www.learner.org/jnorth/fall1998/tulip/index.html
International science project in which students will predict the "official" arrival of spring based upon the emergence and blossoming of tulips. Students design flowerbeds according to standards set by the project. The arrival of the tulips are compared and contrasted with other student projects throughout the world

Self-Characteristics

Genetics MiniUnit: http://www.netlabs.net/hp/ebend/genetics.html
Organized by Beers Street Middle School, students compare and contrast similarities/differences among both human and plant species through the exploration of genetics. In addition, students utilize online data sharing techniques to explore the diversity of the human species.

Environmental Data

Acid Rain: http://earth.simmons.edu/acidrain/acidrain.html
"The purpose of this project is to get students involved in measuring the pH of precipitation and to use this as a means of researching, discussing, and analyzing the complex issues of acidified precipitation and atmospheric pollution..."

Salt Track - Road Salt in Watershed: http://earth.simmons.edu/salttrack/intro.html
This monitoring project will show the results of chemical treatment for highways in winter. Early baselines of salt content will be established to provide students and teachers with an opportunity to observe the movement of a potential contaminate in surface and groundwater systems. Doing so will introduce students to the dynamics of watershed, water recycling, and ecosystem contamination. In addition, students will use concentrations of Sodium Chloride in experimenting with various "crop" plants, and observe the impacts of salination due to irrigation with groundwater supplies. This will also introduce students to the sensitivity of organisms in marine and freshwater systems to changes in salinity levels.

Ozone Monitoring Project: http://earth.simmons.edu/ozone/ozone_protocol.html
The Ozone project uses the EcoBadge® for determining local levels of ozone in ppb. "Applicable to K-12 students in all disciplines and teachers and students with all levels of technological ability. Entry level project participation involves the basic monitoring of classroom ozone levels. Exploratory level project participation involves additional monitoring of ozone levels outside of the classroom, and more sophisticated manipulation and analysis of data."

Global Water Sampling Project: http://k12science.stevens-tech.edu/curriculum/waterproj/index.html
A project that teams up students from around the world to test and compare the water quality of rivers, streams, lakes or ponds with other fresh water sources around the world. Students analyzed data to look for relationships and trends among the data collected by all project participants.

Dare to Share the Air - School Building and Air Quality: http://www.eduplace.com/projects/air.html
Students determine the effect of building age on air quality using school sites as the target buildings. The Environmental Protection Agency sponsors the project by designing the survey the students will use to standardize the project. Students will send the data to other student participants via a web page designed by the participants.

Resource Awareness/Consumption

Drinking Water/Wastewater Treatment: http://earth.simmons.edu/watershed/water_quality.html
Students perform basic chemical tests on environmental surface waters (both fresh and salt) to determine water quality. Water Quality Testing includes the following tests: temperature, pH, dissolved oxygen and biochemical oxygen demand, nitrates, turbidity of dissolved solids, as well as total coliform bacteria count. Water conservation and water pollution issues are also addressed.

Out of the Bin: http://archives.gsn.org/feb98/0006.html
Encourages young people to think and learn about improving their community's use of resources. Students explore ways in which resources can be re-used rather than thrown away in their own community. They will learn from other communities around the world about new ways in which their community might use resources more efficiently.

Content-Related, Participant-Dependent Calculations

Shoot for the Moon: http://ihnet.esuhsd.org/staff/dimasd/moon.html
Students use a parallax to determine distances to far away objects such as the moon. Students utilize geometry and/or trigonometry and mathematical formulas to determine distances. Internet searches as well as collaboration with other students for scientific data is required.

Boil, Boil, Toil and Trouble: The International Boiling Point Project:
http://k12science.stevens-tech.edu/curriculum/boilproj/index.html
Students discover what specific factors (room temperature, elevation, volume of water, heating device) have the greatest effect on boiling point. Standardized instructions and a web-based form to insert data allows students to compare their results with other students participating in the project.

Worldwide Eratosthenes Experiment: http://www.eduplace.com/projects/eratos.html
A simple equation is used to calculate the circumference of the Earth by measuring the shadow of the sun. Students share their results by entering their data onto the project experiment report form. Mapping skills such as knowledge of longitude and latitude are required of the students.

Problem Solving and Engineering

S.O.S - Send out Snow: http://archives.gsn.org/jan98/0027.html
Topic is based on how humans have solved the insulation problem throughout history. Specifically, students create and mail a snowball in the most efficient package to snow-less, southern California. Students who send the snowball receive an efficiency rating based on the amount of snowball surviving the journey. In addition, the students are sent a precipitation acidity printout for their school location from the students in southern California.

Fanciful Machines: http://archives.gsn.org/mar98/0014.html
This is a collaborative problem-solving project which involves middle school science classrooms. Students who participate in the contest create simple machines that perform routine tasks. Students build and test their designs. Classrooms communicate their progress via the Internet. Final products are videotaped and assessed by all participating classrooms.

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Integrating Mathematics, Science, and Technology Education Through the Physics of Space

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Abstract: The teacher professional development project, Integrating Mathematics, Science, and technology education Through the Physics of Space was developed through the collaboration of one university, three museums, NASA, and local school systems. This project is funded through an Eisenhower grant. Components of the project include two summer workshops (1998 and 1999), school-year workshops, and classroom support for teachers. The workshops are designed to provide teachers with models of technology, science, and mathematics integration, allow time to develop familiarity with new technologies, and to improve teachers' content knowledge.

Teachers participating in the project have shown increased content knowledge in math and science and have increased their use of technology, specifically graphing calculators, in their classrooms. Teachers have also increased their knowledge of useful Internet sites, although many teachers are hampered in the use of this technology by inadequate computer systems in their schools.

The need to help teachers develop their ability to integrate computer technology into the teaching of mathematics and science in schools is well-recognized and often reported (Balacheff & Kaput, 1996). Other forms of technology, however, have received less emphasis. Students will need to be adept in not only computer use but also in other forms of technology, such as the graphing calculator. In order for the graphing calculator to become a common tool, students must develop facility with its use during their upper elementary and middle school years. The graphing calculator is a recently developed technological tool and many teachers lack proficiency in using it in their classrooms. Because teachers themselves have not experienced graphing technology supported learning, they have a difficult time using graphing calculators and computers to enhance students' conceptual understanding of mathematics and science. (For example, Streibel (1998) discusses the difficulty of using computers as an intellectual problem-solving tool.). Hence, a professional development program designed to enhance teachers' ability to integrate technology in mathematics and science instruction should include sessions both on the graphing calculator and the computer. These tools should be used to develop students' conceptual understanding and problem solving ability (Battista, & Lambdin, 1994).

In addition to lack of knowledge about the uses of graphing calculators and computers in the classrooms, many teachers have not yet developed an understanding of the national mathematics and science teaching standards (National Council of Teachers of Mathematics' [NCTM], 1989; the National Research Council of the National Academy of Science's, *1996)*. These standards emphasize that the teaching of mathematics and science should incorporate models of instruction that encourage collaboration between disciplines, promote active student involvement in learning, advocate the use of authentic problems, and appropriate use of technology. Lack of teacher knowledge about the standards and lack of time to implement standards-based instruction foster noncompliance.

In order to help teachers increase their use of technology and to increase compliance with the national standards, we developed a project, *Integrating Mathematics, Science, and Technology Education Through the Physics of Space* . Integration of mathematics and science teaching in upper elementary and middle schools through the use of technology was the main theme of our project. During this course of this project, teachers are provided with the time to develop their expertise using graphing calculators and computers and to develop standard-based units for their classrooms. The project began in May of 1998 and will continue through June, 1999.

A Model for Integration

This project provides a model of integration not only in its curriculum, but also in its conception. The program was conceived through the collaboration of Eastern Connecticut State University, NASA, the Discovery Museum, the Science Center of Connecticut, Talcott Mountain Science Center, and, most importantly, local school systems. From ideas generated at a meeting of the principals and curriculum directors and through curriculum materials provided by local school systems, an outline for the project was developed. The schools supporting this proposal identified particular needs that included integrating computers and graphing calculators into the curriculum, improving integration between mathematics and science, and enhancing teacher understanding of physical science concepts (particularly in the areas of motion and energy). The project emphasized the new instructional models using technologies (particularly graphing-calculator and computer applications) and aimed at strengthening teachers' backgrounds in science and mathematics.

The project has four major goals:

1. To offer year-round professional development support and activities to bring upper elementary and middle school teaching practices and curriculum in alignment with the new national and state mathematics and science standards, through a collaboration among university faculty, experts from science museums, and school teachers that resulted in teachers' increased knowledge of mathematics and science content and improved teaching practices.
2. To increase teachers' content knowledge in specific areas of mathematics and science, particularly matter and energy and their interaction; space travel and microgravity; data analysis; and mathematical modeling that includes algebraic and graphical representations.
3. To model and provide teachers' experience with inquiry-based, integrated mathematics and science instruction.
4. To foster teacher expertise, confidence, and skill in the use of technology such as graphing calculators, and computer applications such as Excel, and use of the Internet.

Participating Teachers and Their Backgrounds

A total of 15 upper elementary and middle school teachers from area school districts participated in the summer workshop conducted in August 1998. Even though these were experienced mathematics and science teachers, only a few of them had basic graphing-calculator and computer skills. In addition, these teachers had little experience in designing integrated mathematics and science units. Use of the Internet for finding information relevant to mathematics and to, a lesser extent, science was also new to many teachers. Based on teachers' needs, we designed the activities to include introductory instruction for the graphing calculator, use of spreadsheets, and surfing the Internet for data.

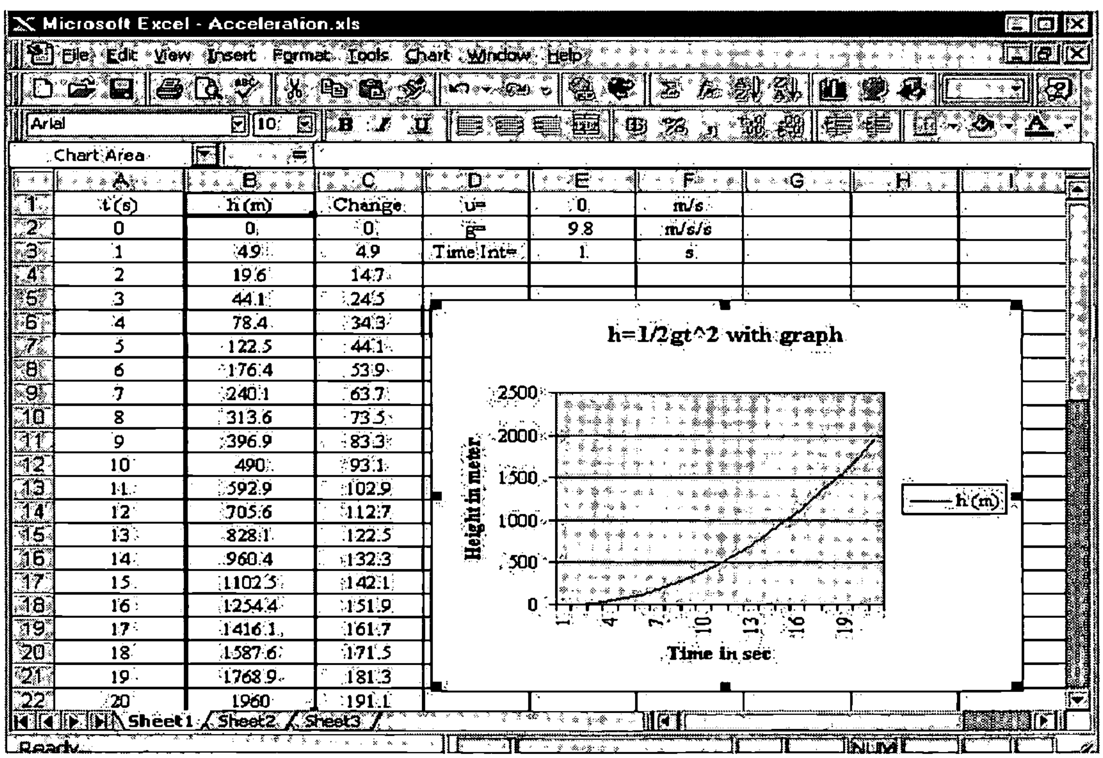
Development and Implementation of the Project

This project includes two summer institutes (1998 and 1999), school-year workshops, and classroom support for the teachers. The first summer institute focused on increasing teachers' knowledge of matter and energy and its interactions; developing their abilities with graphing calculators and Calculator-Based Laboratory (CBL) units/probes; and computer applications, primarily the Internet and Excel. Teachers worked on technology-based, hands-on science projects that involved mathematical content. The activities were rich enough that they could be adapted to a variety of classroom situations and levels. The project developed four themes in order to achieve its goals. The four themes developed for the workshop were Rockets (National Aeronautics and Space Administration, 1996), Microgravity and Orbits (National

Aeronautics and Space Administration, 1997a), Toys in Space (National Aeronautics and Space Administration, 1997b), and Mission to a Comet (Challenger Center for Space Science Education, 1995). Several activities were selected from existing NASA and Challenger materials and adapted for use with graphing calculators. Activities were also adapted to include the use of computer spreadsheets and the Internet. The Discovery Museum, which is also a Challenger Center, was put in charge of the Mission to a Comet theme, the Science Center of Connecticut took charge of Rockets, and Eastern Connecticut State University developed the materials for Microgravity and Orbits and Toys in Space. Talcott Mountain Science Center is involved in assisting teachers in their classrooms.

An Example of Integration using Excel and the Graphing Calculator

Several examples of using Excel and graphing calculators were used in order to integrate science topics such as motion, energy, and gravity to mathematical topics such as algebraic variables, expressions, equations, and graphs. An example of these graphics is the construction of a parabola using the quadratic function $h = \frac{1}{2}gt^2$. This function gives the distance traveled by a falling body dropped close to the earth's surface. Clearly this is an increasing function over time. As we can see in the chart (Figure 1), the distance the object drops after one second is 4.9 meters (cell C3). The distance after two seconds is 19.6 m. Using Excel, teachers were not only able to see the functional values for distance, they were also able to explore the change in distance over 1-second intervals (average velocity). They were also able to explore the increase in the change columns (average acceleration). The fact that the quadratic distance function was the result of constant acceleration was new to many of the teachers. Excel facilitated teachers' understanding of the connection between the numeric information contained on the table, the graphical representation, and algebraic formula. W ithout the use of Excel the calculations and graphing would have been cumbersome and lengthy. If too much time elapses between students doing the experiments and seeing the graphs, understanding of the concepts involved suffers. Therefore, Excel was viewed by the teachers as an effective teaching tool to enhance students' understanding of mathematics and science concepts. Since the speed of computation and the construction of the graph was much faster than doing it manually, students would have time for interpretation, investigation, and understanding of graphs.



	A	B	C	D	E	F
1	t (s)	h (m)	Change	u=	0	m/s
2	0	0	0	g=	9.8	m/s/s
3	1	4.9	4.9	Time Int=	1	s
4	2	19.6	14.7			
5	3	44.1	24.5			
6	4	78.4	34.3			
7	5	122.5	44.1			
8	6	176.4	53.9			
9	7	240.1	63.7			
10	8	313.6	73.5			
11	9	396.9	83.3			
12	10	490	93.1			
13	11	592.9	102.9			
14	12	705.6	112.7			
15	13	828.1	122.5			
16	14	960.4	132.3			
17	15	1102.5	142.1			
18	16	1254.4	151.9			
19	17	1416.1	161.7			
20	18	1587.6	171.5			
21	19	1768.9	181.3			
22	20	1960	191.1			

Figure 1: Excel Graphic of the Motion of a Falling Body

Later, the same data were entered into lists in the graphing calculator and the distance-versus-time graph was created. This gave the teachers an opportunity to compare the same activity using a computer spreadsheet and a graphing calculator. Although the computer graphing looked nicer, the graphing calculator was preferred by the teachers because of lower cost of the calculators compared to computers. Nevertheless, the teachers found the computer's Internet capabilities particularly useful. The teachers enjoyed browsing through the NASA page available on http://spacelink.nasa.gov. They especially liked the photographs of scientific images.

The four-day summer workshop provided teachers with a model of curriculum integration, which would allow students to develop an understanding of space flight and Newton's laws, while developing their mathematical abilities in graphing and algebra. The workshop increased teachers' content knowledge in mathematics and science and developed their technological skills. Teachers also left the workshop with a better understanding of how they could integrate mathematics and science.

Follow-up Session

During the Fall 1998 Semester the participating teachers attended one follow-up workshop (NASA On-Line) and worked on implementing their new techniques and ideas. The NASA On-Line Workshop introduced the teachers to many of the NASA sites and also provided them with additional math and science activities. Our teachers are currently developing or improving a variety of units ranging from Toys in Space to microgravity. One of our parochial school teachers has managed to get her students and their parents so excited about the possibilities of graphing calculators that she has collected donations of $1000 for the purchase of graphing calculators and calculator-based laboratories. In fact, all of our teachers have reacted very positively to the use of this fairly new form of technology with the exception of one fourth-grade teacher.

Conclusions

The *Integrating Mathematics, Science, and Technology Education Through the Physics of Space* professional development project has developed a core of teachers who have responded very positively to the integration of graphing calculators into their curriculum and teaching techniques. These teachers will have additional opportunities to develop their skills at integrating not only technology, but also mathematics and science as the project continues through the spring semester and into the summer. Further professional activities will depend on the needs of the teachers. A survey conducted in December 1998 indicated that teachers found the program very helpful in addressing some of their professional development needs.

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Using Web Resources to Promote Hands-On Collaborative Science Inquiry: The Science Junction

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Abstract: The evolution of web browsers with multimedia capabilities that handle java scripting has enabled authors to move from a "click and look" environment to one in which the user can be involved through communication, interaction and reflective thinking. This environment provides an ideal format for inquiry-based science activities as promoted by the National Science Education Standards. This paper describes the NC State Science Junction website, which serves to promote the *doing* of science through student activities and resources for parents and science teachers.

Introduction

The advent of web-page authoring was characterized by text-dominated pages with few graphics and photographs. As the media has developed, more sophisticated techniques can be used to promote more interactivity. This includes the use of cgi, java programming, and various formats of video displays. The development of the Net Forum enables users to interact with other users using a web-based format. The use of these cutting edge developments along with more advanced web browsers allows creative authors to generate interactive web-based hands-on science activities.

NC State University provided funds for a project called The Science Junction. The primary purpose of The Science Junction is to promote the *doing* of science by students of grades 4-12 through web-based activities and resources. Other purposes of the site include assisting teachers and parents to locate good science learning resources, promoting communication among teachers for collaboration and for the development of a science teacher learning community, and assisting teachers in the learning of new technologies and the practicing of new methodologies.

The Science Junction is indexed into six interconnected areas: The Data Depot, the Teacher Terminal, NC State Frontiers, Student Station, Communications Bridge, and Upgrade Route. Half of these areas are dedicated to student use and half for teacher and parent use. The web site can be found at www.ncsu.edu/sciencejunction/.

Data Depot

The Data Depot contains three sections: Collaborative Experiments, Collected Data, and Simulated Data. The focus of this area is to provide a means for students to post and share data they have collected on various experiments, to extract and evaluate other data previously posted, or to manipulate data generated by mathematical models.

The Collaborative Experiments section includes two activities which involve data collection, posting, downloading and analysis. Water What-Ifs is a web site for encouraging inquiry investigations of water quality in North Carolina and Delaware. Even though the focus is water quality in those two states, everyone can learn how to collect the data and participate in the lab activities included in the site. The water quality parameters addressed at this site include pH, temperature, dissolved oxygen, nitrates/phosphates, and macroinvertebrate surveys. The links to other water quality sites are abundant and are of high quality.

Another collaborative experiment is the Sun and Shadows investigation. In this experiment, students measure shadow lengths and direction of the shortest shadow cast by an object of given height on a given day. By knowing the characteristics of the shadow at the student's location and the characteristics of the shadow cast at a second location, the circumference of the earth can be calculated. When many data are collected from sites all over the world, shadow patterns can be discovered that reveal the motion of the earth. Several activities are included to prepare the students to understand the concepts of time and elements of geometry.

The Collected Data section contains data which have been collected from previous collaborative experiments, and also contains exercises which require the extraction of data from video collections. One such exercise deals with viewing two sunsets on the same day using two video camera at different elevations at the same location. By knowing the height between the two cameras and the time difference between the two observed sunsets, the radius of the earth can be collected. Those who interact in this site must make measurements from the digital video in order to complete the task successfully.

Students can also collect data from virtual reality images. An activity soon to be added to the site will allow students to study the images of skulls of various creatures using virtual reality tools such as the QuicktimeVR Plugin. Students will be able to view the skulls from many angles and to zoom-in on specific areas of interest. By participating in this activity, students will be able to investigate similarities and differences among the skull images, and make inferences about the characteristics of the animals and in what environments they lived.

The Simulated Data section uses data generated from mathematical models. One good use of such generated data is shown in the Solar Eclipse Data Set '98. The data from the solar eclipse of February 26, 1998 was originally generated by NASA. This site includes the data in a modified data set which is useful for pattern finding and analysis. All data sets include a visualization of the data. The solar eclipse data allows the user to select two locations from where the eclipse was visible. The browser allows the user to view the eclipse at the two locations. By looking at various locations, times when the eclipse occurs, and the eclipsed part of the sun, students can discover relationships between location and the parameters of the viewed eclipse. Even though the students did not directly collect the data, they are able to sift through the information using scientific processes.

Teacher Terminal

The Teacher Terminal area is a resource for science teachers which includes IMSEnet and Science Lesson Plans. IMSEnet (Instructional Materials for Science Teachers network) is a large website which lists science websites that have been determined to be useful for science teachers. The websites are categorized by content areas and topics of interest to teachers. When a category is selected, annotations of various web sites are delivered to the user. This resource is a time saver for science teachers who do not have the time nor the expertise to search and evaluate the expanding number of science related web sites.

The Lesson Plans section contain original lessons developed by science educators at NC State to promote inquiry activities in the science classroom and laboratory. One such lesson plan, Carolina Coastal Science, uses photographs to prompt students to reflect upon environmental science issues. Within this site resides a classroom simulation/debate called The Shell Island Dilemma. The scenerio of the dilemma is that the Shell Island Resort is in danger of being destroyed by a migrating inlet. Mason's Inlet is moving south rapidly. The Shell Island Resort is currently situated in an Inlet Hazard Zone and is in dire straits. The objective is to investigate the issues concerning the fate of the Shell Island Resort and then to debate the future of this and other oceanfront structures threatened by coastal erosion. As students engage in the investigation, they must identify the social, political and scientific issues with which different stakeholders must deal. The students are placed into the role of one of the stakeholders. Web-based materials are provided for student research.

NC State Frontiers

The NC State Frontiers area is the place to get information about research projects and research groups at NC State University. Users of this site are able to search by title or by index to locate current science research at NCSU. Graduate students have explained their research projects on many of these pages. Research group research projects are also described here. Read about experiments, see the students, hear about their work, and view their laboratories. This site is useful for the student who asks "why do we need to learn this stuff?"

Student Station

Student Station is a place for students to interact with science outside of a school environment. This area contains two sections: Game Room and Home Experiments. Again, the focus of this area is to promote the *doing* of science. The Game Room allows students to explore with science simulations, and Home Experiments is an area for sources of ideas for hands-on experiments that students can do at home.

The Game Room is a place where students can interact with computer games that teach concepts in the various sciences. For example, Space Trak is a game where the students must move a spaceship around a prescribed path by applying an impulse in a given direction. If the students move outside the path, the spaceship explodes. By interacting with this game, students learn aspects of Newton's first and second laws of motion. Through trial and error, or through analysis of mistakes, students realize that net forces in the opposite direction to motion will cause the spacecraft to slow down, which is required to successfully navigate the turns.

Another Game Room simulation is called REACT! This simulation allows the user to manipulate a *bullet* molecule which will be shot into a *target* molecule. The goal of the activity is to make a reaction occur between the two molecules. After interacting with the simulation students will realize that in order for a reaction to occur the molecules must collide, the collision must occur in a proper orientation, and the molecules must be moving with a minimum amount of speed relative to each other. Students can control the speed and the orientation of the bullet molecule. Levels become increasingly difficult due to the motion of the target molecule. In doing this, students realize that the probability of a reaction occurring on the first collision is low within a random system. The students can also run simulations where they are allowed to observe the number of collisions of molecules in a given space. Students are allowed to control the amount of space, the number of molecules, and the average speed of the molecules.

Home Experiments section provides ideas for students to do simple experiments at home. This area is geared for upper elementary and middle school students. Egg-celent Adventures is a section which provides ideas for experiments with eggs. Other activities are presently in the production phase and will be added as time proceeds.

Communications Bridge

The Communications Bridge is an area which allows science teachers to interact with one another using a variety of tools. The site is for both novice and veteran science teachers. The SciTeach Forum is a web forum where teachers can easily send messages and read what others have to say. Messages are sorted by topic headings, making it easy to find items of interest. Teachers can communicate on the forum on any computer with an internet connection - an email account is not needed. The forum can be used to share tips and to ask questions. Experienced teachers can share knowledge with beginning teachers. The forum is quite active with novice teachers.

Collaborative Connections is a database designed to help teachers to find collaborators for classroom projects. Science Teachers who are interested in collaboration projects can register in the *Join the Database* section. This is a simple form teachers complete and submit to become part of the searchable database. There is a *See and Submit Projects* section which is a web-based forum for teachers to post ideas for collaborative student research. *Search for Collaborators* section allows the searcher to type in a keyword to search through the database of teachers who have signed up in the system. The *View All Collaborators* section allows the user to look at the total database of those who registered. The Collaborative Connections area is an excellent way to promote activities which can be used in the Data Depot area of The Science Junction.

Upgrade Route

Not all science teachers have the ability to attend professional workshops to learn new teaching methodologies and to practice using new technology tools due to the remoteness of their locations or to their hectic schedules. This area provides a mechanism for those teachers to learn about such topics. The Upgrade Route consists of two areas: Professional Development and Technology Skills.

Professional Development provides resources to upgrade the teacher's knowledge of such topics as national science education standards, gender equity, cooperative learning, and multicultural education. This area is textual in nature and provides little interactivity.

Technology Skills provides information on how to use the latest instructional technology advances for science teaching. Need to brush up on using Calculator-based Labs (CBL), capturing video clips, or writing web pages? The Upgrade Route will provide step-by-step worksheets, video, and instruction manuals for a variety of tools for the science classroom.

Conclusion

The Science Junction provides the resources necessary for the promotion of hands-on collaborative science inquiry. It provides links to content sources and professional topics for science teachers which are on other web sites. It supplies a way for science teachers to develop a community with other science teachers for the exchange of ideas and for collaborative activities. It establishes a place for the exchange of data among all who wish to investigate similar topics, and to collect data from visuals and computational models for pattern finding and analysis. The site promotes the use of inquiry methods while students investigate science at home and at school.

The SERVIT Group (Science Education Research on Visual Instructional Technology) at North Carolina State University is involved in the development of this project. The web address for this group is www.ncsu.edu/servit/. Once a critical mass of activities are tested and placed on this website, the research group will study the impact of these activities on students at school and at home. The SERVIT Group solicits any ideas for additional activities to be included in the Science Junction.

"Expanded Integration of Technology with Science and Math Methods Instruction at Nebraska Wesleyan University"

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Abstract: The purpose of this project is to discuss the progress, changes, and findings from the continuation of integrating technology instruction into the science methods course and extension into the math methods course of pre-service elementary and middle school teachers at a liberal arts university. Science, math and technology instruction are extremely important in preparing today's students for the future (Bybee, Buchwald, Heil, Kuerbis, Matsumoto, and McInerney, 1989). Lack of application is often a problem and use of technology is frequently taught in isolation from methods classes. Too many times pre-service teachers do not actually use technology in practicum experiences and student teaching. but only design technology projects for pre-service requirements and infrequently utilize what they have learned. At Nebraska Wesleyan University, the technology skills learned in Instructional Technology are integrated with expectations and assignments in a block of courses, which include Teaching Math and Science in Elementary and Middle School.

One of the goals of our model for integrating technology with science and math methods is to increase the probability that Wesleyan pre-service teachers will more effectively teach these disciplines while also integrating technology in their pedagogy. Changes were made to a similar project completed in 1998 in response to student and instructor reflections and evaluations.

Background

Nebraska Wesleyan University is a liberal arts institution in Lincoln, Nebraska with approximately 1,700 students. The Education Department has approximately 230 students with all students being required to take Education 187, Instructional Technology, a 3 credit hour course. All students who are majoring in elementary education complete the integrated 6 hour block of methods courses, Teaching Math and Science in Elementary and Middle School Last year the project focused on science methods only but this year will include math methods.

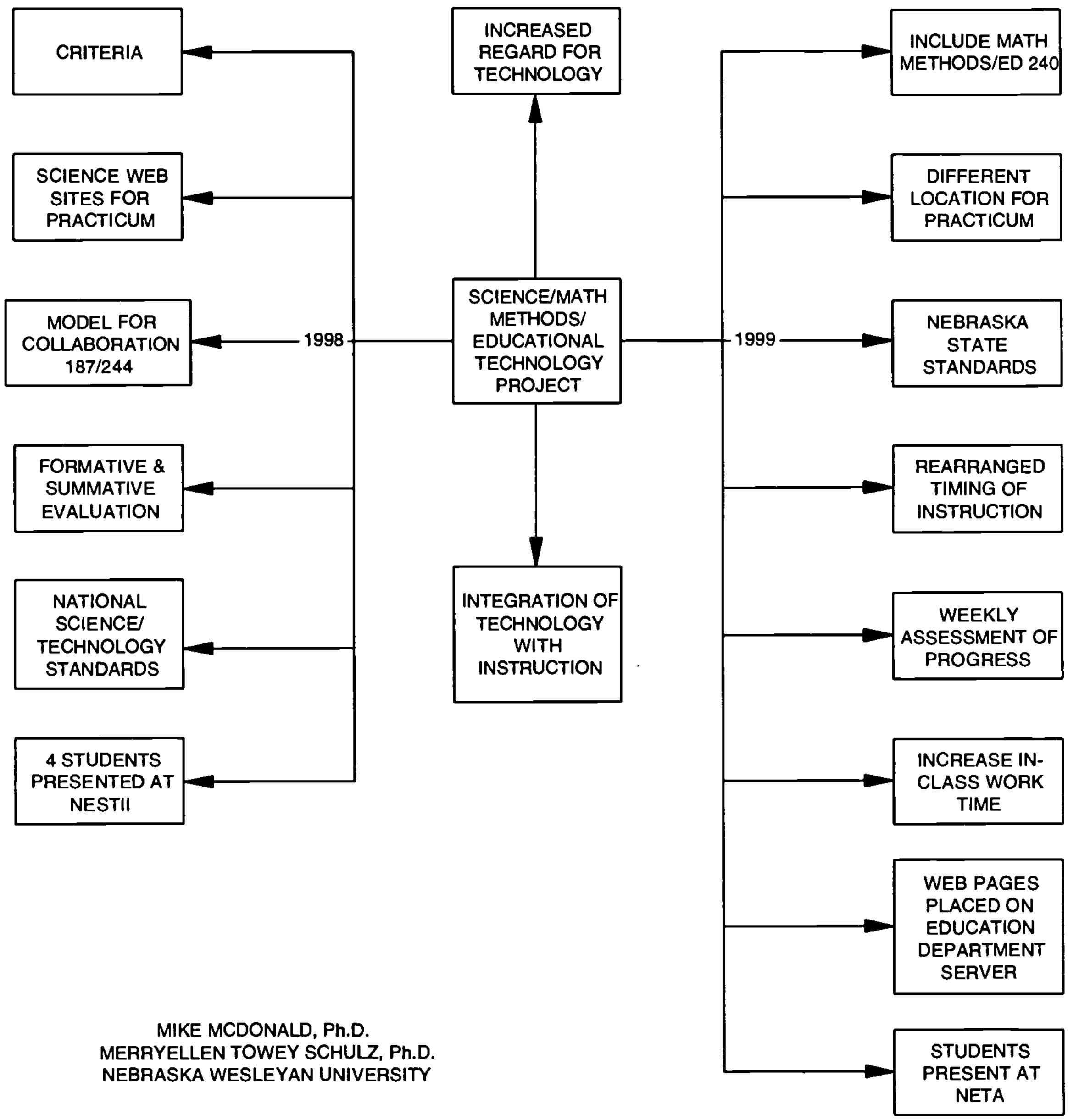
Another goal of Nebraska Wesleyan and the Education Department is to foster collaboration with surrounding school districts while modeling effective integration of technology with instruction. Consequently, collaboration with Meadow Lane Elementary, in the Lincoln Public School District, will be part of the project.

Changes from First Year of Project

Overall the 1998 project was successful. This year several changes will be instituted which will maintain previous strengths and address additional needs of students and instructors (refer to Figure 1). First, students will work at Meadow Lane Elementary which will allow each student to work with the classroom teachers who are directly responsible for science and math instruction. Technology equipment and classroom facilities at Meadow Lane will be more conducive to the project than those at the previous school which is housed in temporary quarters because of construction. Second, the teams of preservice students will be required to present weekly peer and group assessments of their progress. This will provide formative feedback for all parties and importantly allow us to make immediate changes. Third, instructors and student assistants will adjust class instruction in all three courses to allow for increased assistance. For example, the inclusion of Educational Technology lab times on Fridays from 2:00 until 3:30, will make it easier for students to obtain assistance and reduce stress caused by the need to make continual changes to websites. Students will be able to more easily alter their original websites and gain greater control of managing links. Fourth, class time in Teaching Science and Math will be adjusted. As was the case last year an entire four days of class time will be devoted to teaching students to use PageMill and create WebPages, however, this time will occur later in the term to allow students to prepare lessons and materials that will be included in their

websites. After the fourth week the sixty-five minute weekly lab period will be conducted in the computer lab so that students can work on the websites. Fifth, more class time early in the term will be allocated for gathering website resources. These resources will allow students to have increased science and math knowledge base prior to introducing HTML and PageMill elements in the fourth week of semester. In turn, increased emphasis will be placed upon providing models of effective websites and units. Sixth, the pairs of students will be determined by matching grade level and topic interest, Kolb Learning Style Inventory, and instructor knowledge of student abilities. Seven, each student will be expected to create a file of at least 10 lesson plans gathered from other students' websites for use in student teaching and future practice.

Figure 1: Science/Math Methods/Educational Technology Project



Procedure

Teaching Science and Math includes a two-hour per day, two-week practicum experience at a local elementary school. The practicum takes place late in the term after the pre-service teachers have received instruction in "doing science and math", the scientific method, pedagogy of science and math teaching and inquiry, planning lessons and

units, and employing assessment techniques. Instruction will also be given in integrating science and math with the overall curriculum and meeting the needs of individual and special needs children. New Nebraska State Teaching Standards, International Society of Technology in Education (ISTE) Standards, and the National Science Education and National Math Teachers Association Standards will be used to guide instructional decisions of the course instructors and the pre-service teachers (National Research Council, 1996).

Teaching Science and Math will be taught as active hands-on courses, including field trips to important local sources, thereby modeling good science teaching for the pre-service teachers. When it is taught as an active, hands-on experience, science is often the most interesting subject taught in elementary school (Howe & Jones, 1998). These experiences will foster more positive attitudes among the pre-service teachers toward science and math.

Early in the term students in Teaching Science and Math will be grouped into pairs. Partnerships will be determined by grade level for which students are preparing to teach. Each set of partners will be required to create a thematic interdisciplinary unit for use in their practicum classroom. By the end of the semester, pre-service teachers will have compiled files of science and math units, lesson plans, and materials including numerous hands-on exploratory activities. Students will then be able to access websites as well as use their personal files.

Each student will teach one lesson from the unit in a simulated peer teaching situation. After receiving feedback from peers and instructors, students will refine their lessons prior to presenting in the practicum classroom. We have found that peer teaching prior to delivering lessons is effective in preparing practicum students to teach more confidently during practica and more fully preparing students prior to student teaching.

Themes of the units will come from any topic within the areas of technology, physical science, life science, or earth and space science. No two units may use the same topic. In this way the students will gain exposure and materials for teaching as many topics as possible. Students will meet with practicum classroom teachers to determine unit topics that will meet appropriate school district objectives.

Following introductory sessions in which students will experience hands-on science and math lessons; review basic concepts such as the metric system, measuring, observing, and data gathering and reporting; and learn science and math teaching pedagogy, partners will choose their unit topics. Students will be expected to increase their knowledge base on the topic, to explore existing lesson plans for teaching the topic, and to create original lessons and activities to use in teaching the topic. Information that is gathered will be included in the web page that each pair will begin creating the fourth week of the term. Beginning the second week of the term students will begin to construct teaching units and lessons plans to be used in the practicum experience at Meadow Lane later in the term.

During the last month of the semester, pre-service teachers will be onsite at Meadow Lane Elementary two hours per day, Monday-Friday, for two weeks. Students will have visited the classrooms on four earlier occasions to build rapport with the students and the teacher, to learn the classroom routines, and to observe classrooms teachers engaged in teaching science and math. Classroom computers, the school computer lab, and Nebraska Wesleyan equipment will be used as the partners teach their math and science units and facilitate the children in using the web pages. Pre-service teachers will send to instructors email journals, which will provide reflection on events and episodes that occur during teaching and practicum.

During the last week of the term, students in Teaching Science and Math will return to campus where partners will share their web pages in a "Celebration of Learning" with fellow students, parents, cooperating teachers and Wesleyan Education Department members as well as any other individuals students might want to invite. The main intent of the "Celebration of Learning" will be to have students present and critique their units and websites while professionally discussing the strengths and weaknesses of their work. A rubric (developed in class) and based upon the Web Page Project Information will be utilized to evaluate presentations and the websites.

Grade and age level, the nature of the unit topic, and the computer skills of the children will determine the complexity and requirements of web pages. All WebPages from Teaching Science and Math will then be linked with websites created in 1998. This will then provide a repository of lessons for student teachers and graduates who are practicing teachers.

Technology Instruction

During the first week of the semester, students will meet in the Wesleyan Computer Lab to learn how to gather website resources for creating teaching units in math and science. During the fourth week, students will simply begin designing their website while also collecting URLS for placing on the website. Students will also view websites which have been created by previous Educational Technology students. The main intent is to teach how to effectively search the Internet for lesson plans while also acquiring skills to effectively utilize technology. Emphasis will be placed upon developing and utilizing hands-on science lessons through the use of websites.

Students will learn the basics of HTML and Adobe PageMill web editing software for designing a science and math-related website. Students will also learn how to use a digital camera and scanner. Both multimedia tools will be utilized by adding personal, science and math related images to the website after taking pictures and scanning artifacts of student work and activities at Meadow Lane. Each of these actions will model hands on learning while allowing for interactivity among K-16 students. Students will have the option to attend Educational Technology class labs as well as to sit in on the class if they have not taken the class and want added assistance. Extra lab sessions (2-3 throughout the semester) will also be established to provide continued assistance and support in developing the websites and gathering resources.

Several opportunities to present their work will allow students to develop enhanced professionalism and ability to reflect on pedagogy. The websites will be utilized in on-campus microteaching to provide opportunity to refine lessons prior to teaching in practicum. Refinements will then be made and students will be shown how to save their projects to a Zip disc (allows storage of 92 MB) so that students can simulate a live connection at practicum. This consideration allows students to individualize learning yet ensure that Meadow Lane students fully learn the science and math-related information. Participants will provide a 15-minute presentation that will be evaluated by fellow students and faculty.

All students' websites will be linked to one another so students can learn from each other while also allowing Huntington students to link to more resources. The concept of website scaffolding is modeled as students will first design their own website while learning basic HTML elements. Ongoing development will allow students to increase the complexity and capabilities of individual websites while also linking to website of fellow students. In turn, the maintaining of sites on the Wesleyan server (at least one year beyond graduation) will allow students to access the websites beyond the formal practicum while extending into other practica and student teaching.

Objectives of Model:

1) Students will explore the Internet for science and math resources and lesson plans that can be used in teaching science and math to elementary students.
2) Students will learn basic HTML and how to use a web editor, Adobe PageMill, to create web pages.
3) Students will learn to use a digital camera and scanner with images. These images will then be incorporated into web pages.
4) Students will create science and math teaching units on various topics for use at practicum.
5) Students will create web pages that will be integrated with teaching science and math units and links to scientific information.
6) Students will teach the science and math unit to Meadow Lane Elementary students in a practicum experience.
7) An overall web page will link all web pages of Teaching Science and Math students so that students can access classmates' websites which can be used in developing teaching files and actual lessons.
8) Collaboration will be enhanced between K-12 and higher education as preservice and inservice teachers will design units and integrate technology within science and math lessons at Meadow Lane Elementary School.
10) A repository of website-based activities for use in math and science classrooms will be established, linked and maintained on the Nebraska Wesleyan University server. These activities will be continually developed and refined for use in preservice and inservice classrooms as well as for future practicum students and use in student teaching.
11) All lessons will be based upon Nebraska Standards in Science, Math and Instructional Technology.

Evidence to Evaluate Project Success

The project will utilize formative and summative evaluation to assess success. Evidence to determine success will include:

1) Preservice students will maintain email journals during the course of the project. The journals will provide general attitudinal feedback on the use of science and math lessons and effectiveness of integrating technology.

2) The websites will be utilized in science and math classrooms. These websites will be maintained on a Nebraska Wesleyan University server and will be accessible beyond the funding of the project thus sustaining the impact of the project. The websites will be evaluated with a class-designed rubric (refer to Table 1).
3) A mid-term examination will be administered over introductory science and math concepts and methods of instruction (information which will be presented weeks one-eight). Two separate attitudinal surveys will be administered during the first week of classes. One will measure student attitude toward instructional technology and the second will gage students' perceptions of science/math learning and instruction. A pretest on the metric system will be administered on the first day of class.
4) The number of preservice teachers attending the Nebraska State Technology Convention will provide informal assessment of teachers' attitude toward use of technology while also allowing students to gain ideas and network with practicing teachers.
5) Collaboration will be enhanced between Nebraska Wesleyan University and Meadow Lane Elementary School by assistance of preservice students in Meadow Lane classrooms.. Evidence will be determined by informal interviews with Meadow Lane teachers. Cooperating teachers will also be asked to complete a follow-up questionnaire about the program.
6) A "Celebration of Learning" will be held during Finals Week in May. Participants will provide 15-minute presentations that will be evaluated by fellow students and faculty.

Table 1: Criteria for Web Site Design Project

Education 240 and 244
Teaching Elementary/Middle School Science & Math
Spring 1999—Criteria for Website Design Project

Layout / Design	20 possible	Page is well organized with tables. Text spacing and alignment make reading easy. The backgrounds enhance the page. Use color, *italicization,* bolding, line breaks, numbering and/or bullets.
Text	15 possible	No spelling or grammar errors. Fonts easily are readable.
Graphics (minimum 3)	20 possible	Photos, icons, and clip art are used creatively and follow theme. Include: 1. Topical graphics 2. Data 3. Digital or scanned photos of your class
Information	20 possible	Information is creatively written and cleverly presented. Includes 1. Description of yourselves 2. Teaching Unit/Lesson Plans (combined sets) 3. Information about your practicum class 4. Student work (Include only first names of students)
Navigation / Links Teacher links – minimum 5 each subject Content links – minimum 5	15 possible	Links are created with images and icons to enhance the text links. Links all work.
Mailto	5 possible	A link to your e-mail addresses
Wesleyan and Huntington Logos	5 possible	Placed on web page
TOTAL	100 possible	

Comments:

Dissemination of Results and Findings
The instructors will disseminate results and findings by submitting a proposal for presenting at Nebraska State Educational Technology Convention for K-16 teachers. All students and cooperating teachers will be encouraged to attend and two or three preservice students will assist in the presentation, thus fostering professionalism as well as

sharing of findings. Maintenance of the websites on the Education Department server will also contribute to dissemination of the results of the project.

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Nebraska Wesleyan University is recognized as a quality institution. For example, outreach and training are provided to rural science teachers through a Howard Hughes Medical Institute grant. Dr. Michael McDonald from the Education Department has responsibility for technology-based instruction of twelve, science teachers on integrating technology (i.e., website development, use of Hyperstudio, digitizing and scanning still images and sounds, etc). In addition, he has established his classes in accordance with NCATE and ISTE Standards for Technology usage by preservice teachers. The proposed model has also been structured accordingly.

Dr. Merryellen Towey-Schulz is responsible for methods courses in teaching science and math in elementary and middle school and has extensive training and experience in science for elementary and preservice students. Dr. Schulz was instrumental in designing and implementing a technology plan at Nebraska's first schoolwide Title I school within the Omaha, Nebraska Public School System. She has presented at local, state and national conferences (i.e., Nebraska Education Technology Association Conference) on the subject of integrating technology with instruction of at-risk elementary children as well as science education. Dr. Schulz has served as chairman of the Omaha Public Schools (OPS) Computer Outcomes Committee and worked on the committee to design and adopt science outcomes for OPS.

SIMULATIONS

A Faculty Support System for New Distance Learning Initiatives

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Abstract: The purpose of this paper is to examine and describe the role of faculty support in the instructional design of an on-line course. The training model provided focuses on the adaptation of existing courses to implement new technologies. Instructors optimize their course revision efforts by extending the process over several semesters, gradually introducing new delivery strategies as technology, student ability, and institutional support improves. This process includes the choices an instructor must address in the introduction, facilitation, and evaluation of learning experiences at a distance.

Introduction

As new communications technologies impact higher education, faculty must be trained to determine the most appropriate tools for delivery of their course content. Though higher education has not yet reached the stage in which lecture is simply one option among many, the place of distance education technologies has grown to the point that they are no longer novel. Indeed, they are not, in themselves, innovative so much as they have become part of the standard repertoire of most instructors.

The need for continuing professional development and renewal to adapt to this changing environment becomes critical for every faculty member. Every institution has a concomitant need to provide a path for such development in a way that will let its instructors transfer their considerable instructional skills to new media. Unfortunately, the university support generally focuses on the technical and administrative aspects of the approved delivery software package. Armed with the quick reference guide to HTML, the user support manual for the university courseware system, and an unrelated sample course, it is easy for the instructor to lose sight of the original course objects. For this reason it is important to review course objectives in light of the new instructional design tools.

Instructor Training

A good starting place for the new instructor is the Web site for the publisher of the courseware package adopted by your university. Check for instructor training on-line and workshops which offer training beyond the technical operations. For those programs using instructor developed Web pages, on-line templates and tutorials will address the technical aspect of putting the course up, but not the instructional design and management. A Web search will provide a current list of workshop and course opportunities such as Learning to Teach On-line. (LeTTOL, 1998)

Planning and Design

In the process of developing a previously-taught course for the Internet, the instructor makes a series of decisions concerning the instructional value, the academic integrity, and the institutional efficiency of the methodology used.

Though complete re-tooling or comprehensive instructional design for individual teachers and courses is possible, the far more usual procedure is for an instructor to begin adapting a class over a period of a year or more. The instructor can use four or more iterations of the class to effect a change that is gradual and deliberate. An instructional development model that allows a phased-in adaptation to the Web will help instructors to adapt themselves to technology while preserving the best of their practice within a changed environment.

First, the best practice of current instruction must be preserved and renewed. Instructional and evaluative strategies that have been successful in face to face settings need to be examined and, if necessary, altered to continue their salutary effects with students participating from a distance.

Second, technology's instructional enhancements must be incorporated in the instructional design. As technology places new demands on traditional practice, it adds dimensions for learning that were unavailable in older settings. Instructors must recognize, master, and carefully incorporate these innovations. The instructional development model that will serve the needs of both faculty and students much be capable of almost infinite adaptability, however. Compressed and streaming video and real-time audio alter instructional choices. Enhanced web bandwidth alone promises that media such as video that are currently the property of synchronous instructional strategies will become available in asynchronous settings as well.

Moving Systematically to the Web

Staff development can further each step of the move. With planning and sharing among new and experienced faculty members, it can particularly increase the level of comfort students will find when entering into instructional relationships that are facilitated by compressed video, Internet, and desktop video conferencing.

The training model focuses on the adaptation of existing courses to implement new technologies. Instructors optimize their course revision efforts by extending the process over several semesters, gradually introducing new delivery strategies as technology, student ability, and institutional support improves. The instructional improvement models followed for basic distance delivery continue to develop as distance classes, incorporating new technologies.

Let us consider the classroom before distance education. Instruction occurs with lecture, paper handouts, chalkboard, etc. Reading assignments are in the textbook or library, and students attend class, which is where the "real action" -- lecture, presentation, and tests -- occurs.

The Technology Aware Classroom

The first significant change could be called "the technology-aware classroom." Handouts and lectures migrate to presentation platforms like PowerPoint: i.e., the computer and projector replace transparencies and, to a certain extent, chalk boards. Reading lists include URLs, and students as well as instructors are expected to be able to locate, retrieve, and evaluate the sources URLs refer to. Professor & students look to search engines & on-line sources for information, and students communicate by e-mail between class sessions. Class information is transmitted between teacher & students by lecture or on paper. At no time in this process is the essential interaction between faculty member and students within the context of the classroom changed; the simple repertoire that both groups of people employ in learning is enhanced.

Instructors enhance their skills by enlarging their own reading and sources they give their students to include Internet-based documents. They can acquaint themselves with graphical software and should begin a series of visits to Web-based classes and "virtual university" sites. If campus software allows, on-line chat groups, or forums, can familiarize instructors with this form of colloquy.

The Web-Aware Classroom

With the availability of Internet access to every student, the instructor can begin requiring Web-based instructional interaction. Syllabus and handouts should become invariably available by Web or ftp, and should be available in a format that can be used by many media (i.e., .rtf or .pdf instead of simply the instructor's

favorite word processor format). Course bibliographies will include URL citations and instructors will begin assembling material for class through web-based searches.

As student activity begins to include computer interaction, parts of the Web-Aware Class are available through computer sources. Chat groups support classroom discussion; class presentations are planned in e-mail or MUD-based small groups. Student presentations involve both technology-facilitated platforms and materials -- even sites, if connectivity to the classroom is available -- garnered from the Web. Exceptionally well-prepared students begin to participate from a distance, and the classes begin to offer virtual or distance class meetings.

Web-based Class

In the Web-based class, the work of the previous three presentations becomes realized in the first completely distributed class offerings. Transparencies and handouts that have had an interim life as PowerPoint Presentations become Web Pages. E-mail communications become Chat or Discussion-Group interaction, often facilitated by some instructional platform the institution has purchased. URLs dominate reference lists, and html projects become as familiar among student work as printed text. Every class has a distance corollary, so that the skilled instructor can transmit both material and instructional strategy effortlessly between distance and face-to-face delivery.

The Web-based class is not a replacement for a face-to-face class, in most cases. Instead, it is a manifestation of a complete set of instructional and contemplative tools that the instructor has at hand. Designing a class becomes a matter of selecting the most appropriate tools, of course. And the question "is it Internet or Face-to-Face," while important, is no longer a question about innovation. In that context, perhaps the most innovative part of this process will occur when it the choice is only commonplace.

Choices

While much is available on-line and in literature about the technical aspects of electronic course delivery, research about the relationship of the individual instructor to the subject matter, course, and to the individual student is not extensive. Further, the individual choices of how to teach, how to evaluate, and how to be fair to each student remain largely unexplored, perhaps because these matters have always been dealt with by instructors individually or decided by institutional policy.

Designing and delivering instruction consists of choices: selections every teacher makes that begin with deciding whether to engage in detail or in span of subject matter and end with wondering whether individual progress or achieving an absolute benchmark of information is the proper criterion for grading. These aren't true dilemmas, of course, for most of the answers lie somewhere between the limits of the choice.

Internet instruction offers something of the same sort of option sets: a series of points for decision that relate instructional choices to one's ethically-driven view of the student and of the instructional process. Six of those choices are both original with the Internet and ineluctable for the instructor preparing a class for that medium. These are matters of judgment on the part of a professional who must be an expert in a discipline, in pedagogy, and – often, suddenly -- in the technology of this new instructional delivery method. Areas of choice the instructor must explore in designing on-line learning experiences must include:

- **Access** – Availability of equipment, type of equipment, and connectivity clearly influences the effective participation in the course.
- **Learning Style** – The selection of instructional medium including video, voice, sound, graphics, and text must be considered to allow for maximal learning by all students.
- **Technical Skill** – The skill requirements of students enrolling in the course and the nature of technical support to students are important aspects to be examined.
- **Equity** – While many differences are diminished by computer-facilitated communication, other differences may be magnified or hidden.
- **Instructional Support** -- Delivery of courses to students at a distance poses problems in the areas of administrative support, student support, library resources, and bookstore

- **Evaluation** -- Because of problems of test securities when evaluation takes place at a distance, it becomes necessary for instructors to develop a method of evaluation that accurately assesses student achievement without needing to be secret, singular, or independent of text material.

These course decisions can best be accomplished with the help of a mentor presently teaching on-line, either locally or at a distance. By monitoring an in-progress course and surfing for other similar on-line courses, the instructor can explore the new course tools and seeing them in action, can better organize the electronic learning environment for students.

Conclusion

Every instructional choice affects the learners in different ways, and is intrinsic to the subject matter of the class and the expectations of the instructor. The instructional choices of asynchronous, distance education are no different from any other setting in this regard. Likewise, the primary considerations of effectiveness, equity, and rigor do not change from one class setting to another.

Teaching people at great remove from campus, and expecting them to interact with each other and with the intellectual substance of the class without seeing one's self or each other, requires a reexamination of dozens of instructional decisions that were made for the classroom. It also requires evaluating feedback carefully. Changing so much in teaching methodology is a little frightening. Changing instruction without the ability to see or hear students' reactions to the changes can, and probably should, terrify any instructor.

Knowing what choices have been made, and examining those choices in light of student feedback and other people's experience, seems the minimum price of this degree of innovation. Internet-based communication has become a staple of academic communication: the whole system was invented to allow academics to work and talk at a distance. Not offering instruction in this medium deprives students of the opportunity to become comfortable in this central frame of discourse. And not allowing -- requiring -- this kind of access should be more disturbing than innovation at any level.

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Virtual Education: Reality or Virtuality?

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Abstract: For years, many nations have enjoyed technological innovations used in building computers, computer architecture and design, and computer mediated communications. American institutions of higher education have also enjoyed these advancements through successfully establishing Net-based curricula. Success, however, have been limited. Therefore, how might students successfully perform real lab experiments over the Net without being in a laboratory? To explore this challenge, the researchers surveyed numerous DL environments and assessed the effectiveness and disadvantages of laboratory facilities currently available over the Internet. Research revealed that coexistent labs that were promoted as virtual environments were merely software simulations and, at best, created software simulations were far from authentic lab experimentation. Hence, the researchers created an environment that renders remote performance of genuine lab experiments, or genuine remote experiments ("GRE").

1. Introduction

Research suggests that most of the tools employed to train students over the Internet are simulation software, also known as "Virtual Labs." The term "virtual" indicates that the university campus may or may not physically exist. These types of universities offer comprehensive degree programs that deliver course materials through online communications. In most cases, these universities offer the same primary tools of learning as do established universities that offer distance education programs. Hence, virtual universities have emerged as equally acceptable alternatives to conventional universities.

In such environments, the knowledge gained by the student is limited by constraints, boundaries, and other capabilities offered by the manufacturer's simulation software. The examination of literature, existing distance education web sites, and surveys indicate that students are free to perform experiments only in "limited environments" through the programmed design of the software. Hence, these constraints do not permit creativity to flourish, nor do they permit a student to experiment in natural settings where the involvement of human perception fosters learning skills.

This paper suggests an allowable, creative learning environment where authentic lab experiments may take place via the Internet and where students have the unconditional freedom to apply input and feedback of output results as though they attended the experiment in-person. The implementation of the idea is technologically conceivable from recent innovations of fast-prototyping breadboards that allow the building of complex electrical systems from discrete components without the use of wires. At that point, all system wiring (and any future rewiring) are performed via the host computer by the click of a mouse without touching the board. Unlike software simulation, this engaging technology is intended to accommodate high-end fast prototyping and true hardware emulation.

2. The Internet: Planet Information

The Internet's boundless, polymorphous resource of media-based information connects over 25 million people from roughly ninety countries through a massive computer network (Harasim, Hiltz, Teles, & Turloff 1995; Hirumi & Bermudez 1996). Therefore, administrators of institutions of higher education are attracted to expand instructional resources via diverse distance modalities.

During the pioneering of the Internet, its potential was recognized early on as the most dynamic tool in distance learning. (Turoff 1994). The wealth of information that the Internet holds, the constant updates and the ease of transmitting information instantaneously in addition to its cost-effective methods of reproduction, produced a tremendous impetus to make use of what was until then an unattractive, scarcely noticed, mode of distance education (Hirumi & Bermudez 1996; Gaines 1996). Regardless of the costs involved in using Internet technology, few educators seem concerned with the ways that the Internet might assist educational need and learning process as a meaningful, cognitive learning tool. We must ask the following: What instructional strategies and objectives underscore the use of this newly implemented technology? Will this technology assist, enhance, or promote learning? As educators, what do we seek to foster in students?

3. Distance Education: The Tools

Without doubt, the Internet evoked an Educational Renaissance (Jones 1997). As ever-increasing numbers of knowledge-hungry students bore the costly expense of ill equipped on-campus studies, this reawakening in the sharing of information popularized distance education due primarily to outreach and convenience of self-pace (Ferrate 1997) and made learning more affordable to larger numbers of learners (Ayersman 1996). Today, distance education offers varieties of courses that cover nearly every area of study offered by on-campus programs (Walsh 1995) and its annual market of over $8.25 billion *()* attracts some of the world's finest universities.

Fundamentally, the method of teaching adopted in virtual education can be classified as synchronous or asynchronous in that each approach offers a unique advantage (Gibbs 1997). Synchronous teaching contributes to collaborative learning through joint problem solving scenarios and can be used in threaded discussion through active participation of the guide or teacher. Asynchronous teaching frees students from the anxieties associated with group learning and permits self-paced study through repetition (Aotani 1997).

Despite these successes, other specialized fields remain far from ready for online dissemination. Laboratory sessions are vital to engineering curricula, yet today's distance technologies are insufficient in allowing students to complete degree requirements without physically engaging the lab facilities. Software simulations have become the leading solution to this challenge; they enable students to comprehend study materials because greater time allowance permits easy-to-use tools. Software simulation used in "performing" engineering lab experiments via the Internet fostered the establishment of web-based engineering curricula, although the quality of education remains incomparable (Harasim, Hiltz, Teles, & Turoff 1995). How to install GRE on the Internet, therefore, remains the challenge.

4. Survey of Existing Virtual Laboratories on the Internet

Full and part-time virtual laboratory programs of prominent universities in North America and the United Kingdom were examined, as were pure virtual universities that have no established campus structure *()*. Over 80 accredited universities offer more than 2700 distance education courses; although not all of these universities offer laboratory supplements, more than 95% of all providers restrict their curricula to virtual classrooms. The others offer online laboratory courses. However, only the Open University in Great Britain *(;* Van Gorp & Boysen 1997) answered the challenge of providing lab courses over the Internet. Nevertheless, few solutions followed (Alhalabi, Anandapuram, & Hamza 1998).

GRE & Distance Learning

In specialized courses such as Logic Design, Microprocessors, and Electronic Circuits, hands-on laboratory experiments are crucial to understand basic concepts. Describing an experiment or even watching the process being performed by another falls significantly short of the requirements necessary for proper education (Harasim, Hiltz, Teles, & Turoff 1995). Four current alternative methods that provide "lab

experiment" settings are videotapes, home experiment kits, student site facilities, and simulation software (Harasim, Hiltz, Teles, & Turoff 1995). Among these four schemes, field literature indicates that simulation software is the best alternative, because it is easily transportable and cost effective (Gorrel 1992; Thomas & Hooper 1991). The researchers confer, however, that simulation software provides least hands-on experience.

Sending videotapes to students through the mail is probably the most economical method to display GRE off-campus. The Open University in Great Britain (; Van Gorp & Boysen 1997) and Cornell University of Medical Research are academic institutions that use this method. If the demonstration of a simple experiment satisfies the requirement to reach the student in full measure, the program administrators mail a videotape of the experiment to the student. Following this process, an online examiner assesses the student's comprehension of the subject matter by propounding a number of probing questions (Harasim, Hiltz, Teles, & Turloff 1995). Although this method may help students to understand the concept behind an isolated lab experiment, it surely does not deliver the experimental portion of the lab that hypothecates what would happen if input "x" is changed to value "y."

If hands-on experience is deemed essential to course instruction, a specially designed home kit is mailed to the student with accompanying information that instructs the student how to use the kit. The Open University (), for example, designed several kits for courses such as the electronic circuit laboratory (Harasim, Hiltz, Teles, & Turloff 1995). For example, when teaching the highly technical courses of Advanced Logic Design and Microprocessors, the process becomes cost-prohibitive and nearly impossible. Despite the sophistication of the home kit materials, the student may still not have the accessory computing facilities needed to use the kit. Further, the constraints of time and availability may deter the student from accepting these types of courses that offer this option. This method is more practical and delivers hands-on experimentation, but it is not feasible for use in remote geographical areas or in advanced classes.

The third and, perhaps, best choice is to make GRE facilities available near the student site. Although students take classes (theoretical material, exams, etc.) via the Internet, they perform experiments in physically situated laboratories. Alternately, the university can make laboratory facilities available for a week or two on its campus. Intensive laboratory activities during this period helps students so that they may complete the requirements there or in their homes (Harasim, Hiltz, Teles, & Turloff 1995). This method is by far the most satisfactory to the student, but might be unaffordable in terms of travel. In addition, it might be difficult for university staff to open the facilities for such a short duration. These difficulties potentially disrupt the schedules of students who regularly attend the campus. None of the universities surveyed in this paper use this method.

Very few universities offer comprehensive laboratory courses over the Internet, although the Open University at Great Britain has made tremendous progress toward establishing "virtual laboratories." Michigan State University (online Instrumentation Lab, http://www.vu.msu.edu/previews/tc491d) and Harvard University (Psychology Laboratory, http://icg.fas.harvard.edu/~psych17/) offers its students introductory simulation-based virtual lab facilities (Alhalabi, Anandapuram, & Hamza 1998).

Simulation software is one method that imparts practical knowledge by allowing the student, in performing the experiment, to simulate all the steps on the computer that he or she would make in a laboratory's physical environment (Thomas & Hooper 1991). The intended design of simulation software is to deliver practicable, user-friendly laboratory facilities to the student's doorstep (Gorrel 1992). Continual upgrades in software have made aggregate improvements in the domain of distance learning education (Thomas & Hooper 1991). In recent years, the Multiverse Project () developed student-friendly software that provides step-by-step explanations of lab assignments and expected results. Software available in WEB/JAVA has, to some extent, met these requirements but is not devoid of shortcomings. This practice has yet to achieve broader acceptance, although some universities offer these options despite the obstacles.

Simulation software introduces an element of fiction; at best, it might only produce an approximation that may yield erroneous results. Therefore, the student's comprehension of the experiment will depend more highly on the quality of the software than on the comprehension capability of the student. A simulation is not a proper substitute for a real experiment; the design depends largely on the student's perception as anticipated by the designer. The procedures might be more advanced than what the student can capably perform; one step out of sequence renders the exercise futile. As such, the results of experiments conducted through simulation software must be programmed for use within distance learning parameters; therefore, the student must adhere to prescribed inputs that deny significant freedoms to experiment with disparate criteria. The excitement and interest that accompany GRE experimentation may

become nearly absent in simulated environments; such antiseptic conditions may fail to stimulate the student's curiosity. Therefore, the student is more likely to rush through proscribed steps to arrive at the ultimate results. Curiosity is significant because it kindles interest; lack of curiosity by the student typically evokes listless behavior. Therefore, there are no answers to "what if," because the student simply cannot attempt them.

Throughout most colleges, the numbers and types of experiments change from semester to semester. New experiments that accompany each semester's revised syllabus also require content revision, which is often cost-prohibitive and time-consuming. A student who clearly understands the goal of the software at the beginning of the experiment is more likely to produce better results than the student whose understanding falls short. Undesirably, software proficiency becomes tantamount to student proficiency.

5. GRE: Distance Education Ultimate Modality

GRE experiments stimulate higher order thinking skills; GRE environments involve the student's individual senses and learning abilities that foster the learning process. Teaching a student through simulation modalities might assist the student in meeting the course requirements but, ultimately, the student might be incompetent in repeating the experiment in a GRE. Conversely, Real Lab software is designed to bridge those needs. The element of reality is included within GRE environments to remove the student as a passive observer and involve the student as a learner.

6. The Chiller: GRE Online

Originally intended for industrial electronic fast-prototyping and true hardware emulation, the implementation of GRE is technologically possible through recent achievements in interactive breadboarding that investigates unexplored territory in software simulation and allows the wireless construction of complex electrical systems. In the real lab, students are merely rewiring the breadboard, staging the input, and observing the resulting output when they use breadboards to mount Logic Design chips, AND, and OR gates as they connect the chips with wires. Then, the students connect the board to the power supply and observe whether the circuit is functional; if it is not, the students will rewire the board and run it again. If these three actions are performed remotely, the online GRE is successful.

Because the first and third actions are simply the I/O part of the experiment, a standard computer interface with the proper instrumentation device and with an Internet connection can perform these I/O operations. The use of a host computer, however, should not be confused with software simulation because students are still manipulating physically working electronic parts and still have the freedom to make any connections they choose in these lab experiments.

The second action of wiring and rewiring is the challenge. How could students perform the physical act of changing wires on a breadboard without touching it? Standard breadboards are replaced by special interactive breadboards whose pins are connected to a programmable interconnect network controlled by a local computer with a proper software interface. A connection between any pin to any pin is accomplished by a click of a mouse on the software interface.

7. GRE: Instructional Technology and Academic Quality

As the complexity of the digital world deepens, learning institutions that adopt GRE will be able to afford such high-tech tools. Unlike time-shift instruction (experiencing instruction following the live lesson, i.e., videotape, or a software simulation), GRE or real-time instruction (experiencing instruction at some point during the live lesson or experiment) are much more effective and allow students to receive instructions without the teacher's direct presence.

GRE via the Internet furnishes state-of-the-art research environments by utilizing breadboards with programmable interconnecting networks where students at various academic levels can perform complex system experiments without lengthy delays or the high cost of Printed Circuit Boards (PCB). In addition, time-sharing advantages allows many students to concurrently utilize the same breadboard. GRE instructions are based on the principals of Instructional Systematic Design (ISD) the systematic, reflective

process that is vital to making learning environments more creative and effective and is used in translating the principles of distance education, learning, and instruction. These processes are used in complement with the plans of GRE instructional materials, activities, information resources, presentations, process evaluation, and revision (Smith & Ragan, 1999). The ISD process is essential in remote distance education and in carrying out effective GRE instructions where students have minimal face-to-face contact with the teacher and may never step into a classroom or a lab. The Real Labs' ID process follows:

8. Conclusion

Software simulation for academic courses that do not require lab experiments, i.e., history, can meet the needs of learners. Experiments are arranged by two categories: 1) those designed to characterize theoretical concepts to the student through the experiment, and 2) those that are designed to substitute actual experiments where the outcomes depend largely upon various experiments that the student performs. Flexibility during the experiment, the main idea behind GRE, is a perquisite to fostering cognitive and intellectual skills (Barbra 1993). Therefore, experiments that students conduct in real laboratories tend to stimulate curiosity and intensify all types of learning skills. While simulation packages contribute significantly to distance education, they can never replace the need for GRE where students are able to construct their own knowledge and set theory and practice to a real test. Hence, the authors of this paper believe that the idea of GRE could be a vinculum to online laboratories of learning excellence.

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The Simulation of Simulations: Distance Learning and Educational Simulations

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Abstract: Two efforts to provide an experiential learning experience at a distance are discussed. The first looks at the educational simulation Oregon Trail as it is conducted on-line and compares the experience with a similar in-class rendition of the same simulation. The second effort grew out of recommendations from the first project as a graduate level counseling program seeks to simulate counseling sessions via the World Wide Web. This paper will briefly describe the projects and suggest recommendations for the use of simulations at a distance.

Overview

Current models of learning call for teaching practices that require the active participation of students within the classroom. Brown, Collins and Duguid (1989) argue that all learning is activity and situation dependent. "Situations might be said to co-produce knowledge through activity" (32). Leont'ev (1972) provided a mechanism to discuss how external activity becomes internal activity. External processes are subjected to a unique transformation as they are "generalized, verbalized, abbreviated" (18). Classroom simulations have provided opportunities for such active student participation for many years (Shields, 1996). A desire to provide the simulation experience for students even when those students are distributed though space and time has been the effort of recent developments in distance education (Lewis, 1997). The following paper discusses two projects that include on-line simulations delivered at a distance within an educational experience.

The first project looks at the differences between face-to-face and on-line participation in the MECC Oregon Trail simulation. This study examines the thinking process of participants, focuses on the value of the experience as seen through their eyes, and discusses the nature of the student-teacher relationship. Ultimately the question is asked if the simulation achieved similar results when delivered at a distance rather than within typical, face-to-face, situations.

The second project chooses to explore the nature of a simulated counseling session when delivered asynchronously via the World Wide Web. Graduate students at a private Midwestern university who were enrolled in a counseling education program attempted to simulate two counseling sessions: the first employing a Rogerian Person-Centered interview technique and the second Albert Ellis's Rational Emotive Therapy. The course, taught at a distance by two-way audio/video on the Iowa Communications Network, precluded typical teacher/student interaction. A shift to asynchronous web-based sessions allowed for teacher modeling, scaffolding, and intervention (Westwood, 1994).

Oregon Trail--At a distance

Although past research has shown that students have found simulations motivational, students have not learned significantly more information than students who have learned the information by more traditional methods, such as reading and lecture (Jurica, 1997). This study examined the thinking process of elementary age children as they engaged in the Oregon Trail simulation. The participants in the study were five fourth grade students and six fifth grade students from a rural school located in the southwest United States. The students' teachers also participated in the study.

During the first six weeks of the study the fourth grade students were observed as they studied the westward expansion of the United States during the 1840ís. The teacher used a variety of teaching methods during the six weeks including the in-class simulation of travel along the Oregon Trail. The fifth grade students studied westward expansion by participating in Oregon Trail On-line sponsored by the Minnesota Educational Computing Consortium. Both groups recorded their decisions on an audiocassette as they proceeded through the simulation. After completion of the simulation the students and teachers were individually interviewed..

All of the fourth grade students (in-class version) reported that they thought the simulation was a valuable use of class time because it gave them the opportunity to apply the information they had learned. Three of the fifth grade students (on-line version) reported the Oregon Trail simulation was a valuable use of class time, but only because it was fun. One fifth grade student reported he learned more information from the textbook and he did not see the value in the simulation. Only two of the fifth grade students believed the simulation was a good use of school time because of the educational benefits of the simulation.

The in-class version of Oregon Trail was Oregon Trail II, a newer incarnation of the venerable simulation classic, which provided students with more decision making opportunities. It also gave students a chance to travel the trail more than once which allowed students the chance to experiment and take chances. With Oregon Trail On-line students never had the opportunity to revisit problems and test new hypotheses as their version was identical to the original simulation. However, the structure of the on-line version capitalized on a cooperative learning environment. After receiving the question(s) for the day the class had an opportunity to discuss the problem and vote on a course of action. The daily question would also provide the teacher with an opportunity to address a particular issue.

Regardless of the method in which they are presented (on-line or in-class), computer simulations seem most successful when there is a direct connection between what the simulation teaches and the desired outcome. For example, there is a direct connection between a student pilot learning the controls of an airplane and the lessons a flight simulator teaches. However, there is not a direct connection between the Oregon Trail and the desired student outcomes as determined by many teachers. Oregon Trail simulates travel on the Oregon Trail; it does not teach facts associated with the Trail. Yet, the Oregon Trail and other educational simulations are judged based on how well students perform on an objective test. Most educational programs are judged based on how well the program helps students remember facts or how well the program helps students perform on a standardized test. Under this criteria simulations have not performed well. Yet, many students find simulations fun and motivational. The motivational aspects may increase the interest some students have in a subject. While simulations may not increase students standardized test scores, they may help students in some area that educational researchers have not yet examined. One such area may be problem solving skills. Perhaps it is time to the change the criteria of how educational programs are judged. As computers and computer software become more sophisticated, simulations may yet prove beneficial in educational settings.

Based on the observations of the two classrooms in this study, the following guidelines are offered to help teachers successfully integrate simulations similar to the Oregon Trail into the curriculum.

- Teachers need to have a strategy of how to incorporate the simulation into the lesson. The students need to understand the educational reason for engaging the simulation. Students require background information not only to help them make decisions as they proceed through the simulation, but the background information also makes the simulation more relevant. The students know what is

expected of them. The in-class group viewed the Oregon Tail simulation as part of their learning experience. They had a chance to apply what they had studied for the past six weeks. The on-line group did not understand the relationship of the simulation the Oregon Trail to their unit on the Oregon Trail.

- Although background information is important, the debriefing session at the end of the simulation is critical. A teacher who fails to debrief her students after a simulation can be compared to a basketball coach who pulls his team off the court after the third quarter. If a basketball coach expects to win the game, his team must play the whole game. If a teacher expects her class to get the full benefit of a simulation, then she must dedicate some class time to debriefing.
- Teachers likely need workshops about how to integrate computer simulations and other materials into classroom lessons.
- Teachers need time to prepare lessons that examine topics in depth.
- And finally, teachers need support from administration.

Up close and personal?

"How can I train my students in counseling from a distance? I need to be in the same room with them in order to coach them as they begin to explore the various approaches to counseling theory." One of the authors asked this question while developing his course syllabus for a counseling methods class being taught at a distance via the Iowa Communications Network. During a subsequent brainstorming session it was determined that capturing student counseling sessions through a web-based simulation and debriefing these student sessions during large group two-way video sessions might allow adequate teacher scaffolding for student development as counselors. The experiences of other simulations at a distance, such as the Oregon Trail study previously described, helped inform the decision-making process.

Counselor educators are confronted with technological innovations that are changing the nature of higher education. Distance education has proved to be a cost-effective mode of instructional delivery that increases learner access by accommodating the schedules of a nontraditional student body (i.e., older adults with job and family responsibilities). As such, distance learning is rapidly becoming an established presence in higher education. Courses and programs are being delivered through a multitude of nontraditional formats, such as computer conferences, one -and two -way interactive television, and audio and videocassette. A wide range of counseling and psychology courses and related degree programs are offered via televised instruction through the United State and other areas of the world (Burgess, 1994; National University Continuing Education Association, 1993). As a result, it is conceivable that future mental health professionals may complete much of their educational training via distance learning delivery systems (e.g., two- way interactive televised instruction and web-based instruction).

Several authors have outlined strategies for delivering courses at a distance (e.g., Naidu, 1994; Cahill, & Marland, 1995; Price & Repman, 1995). These proposals tend to focus on general teaching approaches, such as developing organized visuals, maintaining eye contact with the camera, and developing technical competence, rather than course/topic-specific instruction. Instructional software packages relevant to the counseling profession are available (Parker & Monson, 1980), and one-way television has been used in an attempt to teach counseling methods (Ancis, 1998; 1996). However, specific strategies for teaching counseling coursework using current technology (e.g., two-way interactive video/audio and World Wide Web instruction) have not yet been thoroughly researched and addressed in the literature.

Accordingly, instructional methods utilizing differing forms of distance learning technology need to be researched. For example, how an instructor may best facilitate the processing of students' varied affective and cognitive reactions to counseling experiences and what impact the instructor's physical presence (or

lack of) has on this process is necessary to the structuring of effective distance learning training. Moreover, research needs to be focused on the impact of instructional approaches designed to encourage colloquy and inner-directed thinking among students representing various levels of preparedness and cognitive development, and who are physically separated from each other. Knowledge regarding the degree to which counselor education training via two-way interactive television and web-based instruction can facilitate self-directed thinking and counseling competence is needed to structure counselor education training programs to deliver training at a distance. Synthesizing the many forms of technologically based learning into a coherent distance learning instructional program, designed to accommodate student needs while maintaining program integrity, is the task for the counseling education domain during the next millennium.

This paper will outline an approach to the challenges and potential value associated with using simulated counseling sessions when delivered asynchronously via the World Wide Web. The challenges of utilizing traditional instructional practices in a skills-based course that progresses from the learning of basic listening skills to more advanced counseling theory-based approaches using two-way television and web-based instruction are explored. The graduate counseling education course uses real and simulated videotaped demonstrations during the actual two-way televised distance learning class session that meets weekly for three hours. Then, during the interim between the weekly class session, students must log on-line and use an interactive web-based instructional method that illustrates two theoretical approaches to counselor interviewing.

The World Wide Web-based computer generated video depicts a counseling session in action (with actors) that model the text -and -videotape viewed counseling interview method previously discussed in the distance learning class session. Mid-way through the depicted session, the counseling role-play ceases and the student must continue the counseling session by using a response box and typing a running narrative of the remaining counseling dialogue that should ensue (based on student's knowledge of the theoretical method being depicted). The response is forwarded to the course instructor for evaluation and feedback.

The web-based simulation is but a single component of a larger Iowa Communications Network (ICN) delivered experience. The authors believe that the debriefing held during a regular ICN class provides the key for the success of the project. The debriefing allows the instructor to respond individually to each student's counseling effort much in the same manner as if the instructor were to work with a small group of students in a face-to-face situation. Other areas of importance, as demonstrated by the Oregon Trail On-line simulation, are having (1) clearly articulated student outcomes, (2) training, and (3) time for proper development of materials.

Distance Learning and Educational Simulations

As educators confront the challenges of teaching at a distance and providing learning experiences which are both situated in activity and mediated by social interaction, new approaches to old solutions need to be attempted. The authors are encouraged by the results of the use of simulations conducted at a distance to promote motivational stimuli, social interaction, and skills-based outcomes. To provide these when students and teachers are separated by time and space is as important as if the classroom were traditionally situated.

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Using a Simulation To Assess Teacher Lesson Planning for Students Differing in Emotional Intelligence

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Abstract: The purpose of this study was to explore how a group of 74 inservice teachers, collaborating in pairs, planned a short language-arts lesson for a class of simulated pupils who exhibited maximum contrasts in emotional intelligence. Analysis of navigation variables revealed that the teachers expended more effort in deciding how to meet the needs of Low-EQ pupils than the needs of High-EQ pupils. Further analyses revealed that the teachers planned more structured and teacher-moderated lesson experiences for Low-EQ pupils and more flexible and student-controlled lesson experiences for High-EQ pupils.

Introduction

Much current attention focuses on how school experiences contribute to children's social-emotional development. As Daniel Goleman (1996) notes, "...the neurological window of opportunity for the emotional centers in the brain extends into adolescence. So teachers can have a more intentional role in helping children master the socialized emotional skills they need" (p. 55). The present study employs a recently developed version of the Teaching Decisions (TD) simulation to determine how experienced teachers plan a lesson for a class comprised of pupils exhibiting wide variations in emotional intelligence (EQ). This study's major goal is to uncover basic strategies that experienced teachers exhibit as they attempt to meet the needs of their individual pupils. If variables defining such strategies are found, they will be incorporated into the debriefing feedback displays that Curry preservice teachers view at the conclusion of their simulation-based lesson-planning exercises.

The Lesson-Planning Simulation

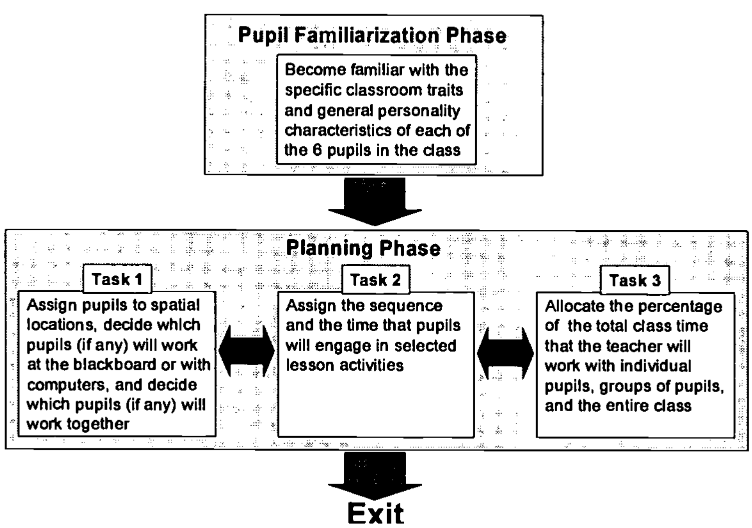

Figure 1: Simulation Navigation Path

The simulation exercise entails planning a 30-minute language-arts lesson for a small class of 5th-grade pupils. The simulation's Visual Basic program, described by Strang (1996), has been reconstructed to include the two phases shown in Figure 1. The participants' sole task during an initial reflective phase is to study the specific classroom traits and general personality characteristics of six software-defined pupils. In the present study, 3 male-female pupil pairs are preprogrammed to illustrate high, moderate, and low EQ levels. Figure 1 displays the program window depicting the classroom and personality traits of a Hi-EQ male pupil named Sam. The arrow configurations in the display of a Low-EQ male named Norm would appear as vertical reversals.

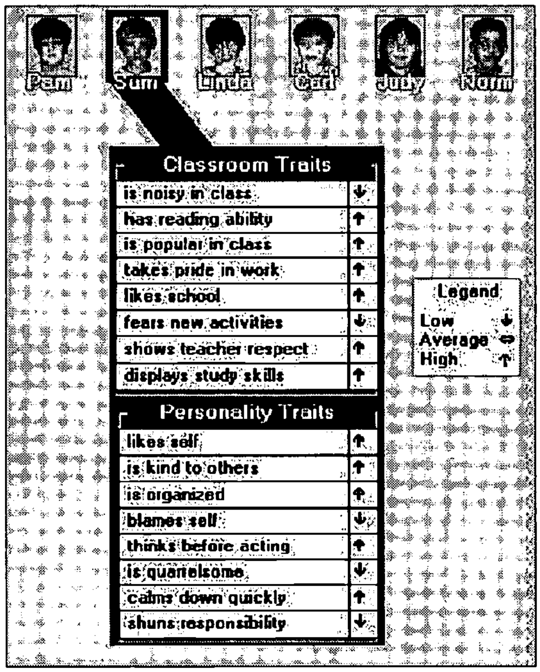

Figure 2: A Typical Profile of Pupil Classroom and Personality Traits

After familiarizing themselves with their pupils, participants complete a 3-task planning phase that includes making spatial-interpersonal decisions, determining lesson activities, and allocating teacher time commitments. The spatial-interpersonal task involves assigning pupils to locations within the room, deciding which pupils (if any) will work at the blackboard or with computers, and deciding which pupils (if any) will work together. The activity task involves assigning the sequence of and the relative amounts of time that pupils will devote to selected or participant-authored lesson activities. The teacher time task centers on allocating the percentage of the total class time that the teacher plans to spend working with individual pupils, with groups of pupils, and with the entire class. Throughout the simulation's planning phase, participants can navigate freely from one task area to another. They also have immediate access to a feedback window located adjacent to the current work window. Via a single click they can view (1) graphical depictions of decisions already registered for previously addressed tasks or (2) the individual pupil personality and classroom trait profiles that they studied in the reflection phase. After finishing the three decision tasks, the teachers complete an on-screen questionnaire before exiting the simulation.

The Current Study

The participants in this study were 74 experienced elementary and secondary teachers enrolled in parallel off-grounds Master's of Education programs at two University of Virginia satellite locations. These teachers completed the lesson-planning simulation and a debriefing session as part of a laboratory component in a course in human learning and development. The simulation introduced a unit on meeting

the needs of individual learners. The professor conducted a 10-minute demonstration at the onset of the laboratory session. Next, the teachers, randomly assigned in pairs to maximize cooperative learning, could engage in the lesson-planning activity for as long as 50 minutes. At the completion of this exercise, each teacher pair received a printed form that clearly displayed numerical information summarizing how they planned the lesson for each of the class' 6 pupils. At this time participants also completed a 30-minute group debriefing session during which they compared the information on the personalized printed forms with group averages for each variable. The group information consisted of a series of program-generated histograms and tabular reports displayed on a wall screen by an LCD projector. This rich feedback environment was designed to set the stage for meaningful discussion on how best to meet the educational needs of pupils of varying levels of emotional intelligence.

Navigation and Outcome Variables

Two important classes of simulation-generated variables were developed to study how the inservice teachers attempted to the meet the learning needs of pupils demonstrating either very high or very low levels of emotional intelligence. The first class focused on the navigation behavior exhibited by the participants during the lesson-planning phase. Navigation variables included (1) the frequency with which teacher pairs consulted the personality and classroom trait profiles to obtain information on individual pupils, and (2) the frequency with which they changed their decisions as they dealt with individual pupils. The second class of variables addressed the outcomes of teacher planning decisions for individual pupils for the three tasks that comprised the simulation's second phase. Task 1 variables defined the nature of spatial and interpersonal assignments; task 2 variables defined the type of lesson content that was assigned; and task 3 variables defined the time commitment that teachers made to individual pupils.

Results

Since the purpose of this study was to explore how experienced teachers planned lessons for pupils who exhibited maximum contrasts in emotional intelligence, data obtained from the two pupils assigned "mid EQ" characteristics were excluded from the data analysis. A 2(EQ level) by 2(Sex) repeated measures factorial analysis of variance was applied to variables that were amenable to parametric testing, and descriptive statistics were applied to other variables.

Navigation Variables

Teacher navigation decisions during lesson planning were clearly influenced by the characteristics of individual pupils. The results of an analysis-of-variance applied to the variable that defined the frequency of teacher referrals to pupil characteristic profiles yielded two significant main effects. During their decision making, teachers studied significantly more Low-EQ pupil profiles than High-EQ profiles, $F(1,36) = 5.77, p < .05$. They also studied significantly more female profiles than male profiles, $F(1,36) = 4.93, p < .05$. Means and standard deviations for the four pupil types are shown in Table 1.

	Pupil Types							
	Low-EQ Female		Low-EQ Male		High-EQ Female		High-EQ Male	
Variable	M	SD	M	SD	M	SD	M	SD
Pupil profile recalls	1.70	1.98	1.35	1.60	1.14	1.55	1.11	1.45
Task 1 pupil spatial changes	2.11	1.41	2.03	1.48	1.95	1.08	1.95	1.10
Task 2 content changes	.54	.96	.62	1.01	.35	.72	.59	1.01
Task 3 tchr commitment changes	.35	.63	.35	.79	.05	.23	.16	.37

Table 1: Means and Standard Deviations for Navigation Variables

Analyses of variance were also applied to the last three variables listed in Table 1. These variables depicted decision changes concerning individual pupil lesson experiences which teachers made as they completed the phase-2 tasks. The first two analyses yielded no significant effects; the third yielded a significant EQ main effect, $F(1,36) = 8.03$, $p < .01$. The teachers changed the amount of time that they planned to interact with individual pupils significantly more often for Low-EQ pupils than for High-EQ pupils.

Planning Outcome Variables

Variables in this category included quantitative measures of how the teacher proposed to address the instructional needs of each the class' six pupils. Spatial-interpersonal placement results revealed that pupils, regardless of EQ traits or gender, were most likely to be assigned one or two work partners. Actual percentages for solos, pairs, and triads were 11%, 53%, and 33%, respectively. Only one 4-pupil group was constructed, and no pupils were assigned to work in larger groups. Data on the characteristics of the groups were also tabulated. Only 14% of the Low-EQ pupils were assigned to a group that contained another Low-EQ pupil, and only 27% of High-EQ pupils were matched in their grouping assignments. The probability that a Low-EQ pupil would work with a High-EQ pupil was 49%. Finally regarding gender groupings, 65% of Low-EQ students and 73% of Hi-EQ pupils were assigned to work with at least one pupil of the opposite sex.

The second planning task focused on the teacher's assigning pupils and/or pupil groups the percentage of class time that they would devote to as many as three separate content activities. Table 2 presents the means and standard deviations for the percentage of lesson time for four commonly assigned lesson activities.

	Pupil Types							
	Low-EQ Female		Low-EQ Male		High-EQ Female		High-EQ Male	
Variable	M	SD	M	SD	M	SD	M	SD
% information-reception activity	14.89	15.56	16.38	16.39	10.41	12.68	11.35	12.53
% group example activity	12.46	14.45	12.51	15.46	5.96	10.14	8.46	14.86
% project activity	20.24	27.68	16.86	26.30	37.05	29.12	36.70	27.52
% teacher-authored activity	15.01	27.85	10.76	20.79	7.70	18.73	6.89	19.80

Table 2: Means and Standard Deviations for Activity Assignment Variables

Each of the four analyses of variance yielded a significant EQ main effect. Low-EQ pupils were assigned significantly more time that focused on their receiving specific information about the current concept, $F(1,36) = 5.00$, $p < .05$; on their being provided with as many group examples of the current concept as possible, $F(1,36) = 6.44$, $p < .02$; and on their being provided with specific activities that the teacher created to meet their individual needs, $F(1,36) = 3.57$, $p < .07$. High-EQ pupils were assigned significantly more time that focused on creating projects that linked the main lesson concept with other concepts, $F(1,36) = 17.26$, $p < .01$.

The third planning task focused on the relative amount of lesson time that the teacher planned to devote to the class, to groups of pupils, and to individual pupils. The results of an analysis of variance performed on the variable defined by the percentage of teacher-time assigned to individual pupils yielded a significant EQ main effect, $F(1,36) = 30.68$, $p < .01$. Means and standard deviations (in parentheses) for the Low-EQ female, Low-EQ male, High-EQ female, and High-EQ male pupil types were 8.95 (8.66), 7.97 (7.65), 2.89 (3.58), 2.92 (3.60), respectively. As these means illustrate, the teachers planned to spend almost three as much time interacting individually with Low-EQ pupils than with High-EQ pupils.

Summary and Implications

The purpose of this study was to explore the strategies that experienced teachers display in planning a short language-arts lesson for a small class of elementary-level pupils who exhibit contrasting

levels of emotional intelligence. Before consolidating the results of the various analyses to discuss several general planning patterns, it is important to note that the majority of the measures which were submitted to parametric statistical analyses (e.g., refer to Table 1 and Table 2) exhibited a high degree of variability. This suggests that beneath the global cohort planning patterns lies a rich store of highly individualized strategy information--a store that is readily accessible for future quantitative and qualitative analysis.

Collectively, the group results of the parametric analyses applied to navigation variables suggest that the teacher-pairs expended more effort in studying the characteristics of both female and Low-EQ pupils. Furthermore, the EQ-effort factor seems to appear again by the participants' elevated frequency in decision changes related to the amount of teacher-time that was to be devoted to Low-EQ pupils.

The group-planning outcome results complement the EQ navigation findings. Here, the Low-EQ teacher-effort factor directly translates into a disproportionately high amount of teacher time that will be devoted to meeting the needs of the Low-EQ pupils. The lesson-activity assignment results help to explain the nature of the perceived needs of Low-EQ pupils. These pupils are apt to be assigned highly structured teacher-moderated activities--activities that require the teacher to provide specific concept information, multiple examples, and individualized teacher-authored lesson experiences. High-EQ pupils are more apt to be assigned more flexible student-controlled activities--tasks such as projects that rely less on teacher attention and more on the intrinsic motivation of the pupils.

The findings generated from the current study will be incorporated into the group debriefing sessions that Curry preservice teachers engage in after they complete the lesson-planning simulation during their coursework sequence. It is anticipated that by comparing their personal planning records with both individual and collective planning results provided by the experienced teachers, these neophyte teachers will have a concrete base of both personal and comparative information from which to initiate a meaningful dialogue with instructors and classmates. This important dialogue will address specific issues relevant to meeting the needs of pupils varying in the important adaptive dimension of emotional intelligence.

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The Effects of Cooperative Participation on Preservice Teachers' Lesson Planning in a Computer-based Simulation

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Abstract: This study explored the effects of collaboration versus non-collaboration on preservice teacher performance on a computer-based simulation. The simulation focused on planning a short language arts lesson for a small class of fifth-grade pupils who presented high contrasts in emotional intelligence. A group of 34 elementary education students self-administered the simulation as part of a laboratory requirement in an introductory educational technology course. Findings suggested that non-collaborative participants were more likely to exhibit a higher level of indecisiveness than collaborating participants. Sustained feedback-rich dialogue with a colleague appeared to supply mutual support in dealing with a decision-making task that offered a high degree of learner choice and a minimum of distinct right-or-wrong answers.

Introduction

Over the past four years more than 200 preservice teachers at the Curry School of Education have completed a lesson-planning simulation as a laboratory requirement in an Introduction to Technology in Education class. This interactive experience has provided our teachers-in-training with valuable insights concerning their general lesson-planning strategies (Strang, 1998) and their sensitivity to the needs of individual pupils (Strang, Sullivan, and Yeh, 1996). Throughout this period efforts have been directed toward increasing the simulation's instructional benefits while improving its ease-of-use and administration efficiency. The present study explores the benefits and shortcomings of assigning the simulation as a collaborative student exercise rather than, in its traditional mode, as an individual student assignment.

The Simulation Exercise

The simulation allows participants to plan a 30-minute language arts lesson for a class of fifth-graders. The class' six "virtual" students, three male-female pairs, are preprogrammed to represent high, average, and low levels of emotional intelligence. Participants begin the exercise by engaging in a reflection phase during which they familiarize themselves with the academic and personality characteristics of each pupil. Next, during a planning phase, they complete three lesson-planning tasks that include:

1. assigning where each pupil will work, with whom the pupil will work ,and whether the pupil will use blackboard or computer aids;
2. assigning the sequence of and the time that pupils will spend engaging in selected lesson activities; and
3. allocating the time that the teacher anticipates spending with individual pupils, groups of pupils, and the entire class.

During the completion of the planning phase, participants have instant access to a variety of information screens. These displays, accessed via a single click, present information ranging from the pupil characteristics presented during the reflection phase to a graphical history of participant decision-making activity during the planning phase.

After finishing the planning phase, participants are asked to complete a seven-item on-screen

questionnaire. One item cluster addresses the perceived value of the experience; another addresses the relative importance of each of the simulation's four tasks.

Several weeks after completing the lesson-planning exercise, students attend a one-hour group debriefing session during which they receive explicit personal feedback on their simulation performance. The presentation of projected graphics, depicting group averages for the total class and/or for experienced teacher cohorts, allows students to compare their own personal decision making with that of others. These feedback comparisons stimulate meaningful discussions about lesson-planning strategies. At the end of this session the students evaluate the total simulation experience via a paper-and-pencil questionnaire.

Self-administration

During the current year, participants self-administered the simulation exercise. A single floppy disk, containing the lesson-planning software, also served as a storage vehicle for participant files. The preservice teachers signed out the disk and an instruction manual from the education school library and completed the exercise at their convenience.

There were two sources of simulation-related instructions. First, an overview of the assignment and precise instructions for completing the exercise were provided in a class session at the beginning of the semester. Students were encouraged to ask both general and specific questions during this 40-minute session. Second, instructional aids were an integral component of the simulation software. At the onset of the exercise, a text screen reintroduced the exercise's two phases and four tasks and its major navigational features. As participants completed each of the four tasks, on-screen help was immediately accessible via a single mouse click.

Group Assignment

Participation in the simulation exercise was an assigned laboratory requirement in the fall 1998 offering of the Introduction to Technology in Education course taught at the Curry School. Participants in the study included 34 preservice teachers enrolled in the two elementary education sections of this course. One class section was randomly defined as collaborative; the other, as non-collaborative. Students in the collaborative group were randomly assigned a partner, and the resulting pairs (N =11) cooperatively completed the lesson-planning exercise. Students in the non-collaborative section (N = 12) individually completed the same assignment.

Variable Categories

Three types of variables were used to assess differences between students in the collaborative and non-collaborative groups.

1. **Decision-Processing Variables**. These measures depict participant navigation patterns and use of available information resources. Specific variables address the frequency of revisiting planning tasks, the frequency of changing lesson-planning decisions, and the frequency of engaging in planning tasks without tapping available feedback resources.
2. **Decision-Outcome Variables**. These measures define the ways in which teachers, as they complete the three planning tasks, develop a lesson to meet the needs of their individual pupils. Specific pupil-focused variables include the size of work groups, the percentage of lesson time assigned to information reception and project activities, and the percentage of teacher time allocated to individual pupils.
3. **Simulation Evaluation Variables**. A third variable category includes the three end-of-exercise participant ratings obtained from the onscreen questionnaire. Specific variables address the simulation's user friendliness, clarity in portraying distinct pupil learning styles, and relatedness to future classroom lesson planning.

Results

Decision-Processing Variables

The first decision-processing comparison across the two groups addressed the frequency with which the teachers revisited specific tasks during the planning process. Non-collaborative teachers more frequently exhibited this behavior than did collaborative teachers, $t(21) = 1.81$, $p < .09$. Two variables defined by decision change were also analyzed. No statistical group difference resulted from a comparison of the task 1 variable depicting the spatial repositioning of pupils, $t(21) = 1.05$, $p > .1$. An inspection of group means, however, revealed that non-collaborative teachers initiated this behavior 53% more frequently than did collaborative teachers. A comparison of task 2 lesson activity changes yielded a significant group difference, $t(21) = 2.21$, $p < .04$. Again, non-collaborative teachers initiated this decision-change behavior more frequently than did collaborative teachers. Finally, non-collaborative teachers were significantly more likely to complete a planning task without tapping available resources which provide valuable information on pupil characteristics and previous lesson-planning decisions, $t(21) = 2.29$, $p < .04$.

Decision-Outcome Variables

Since this exploratory study focuses on studying how teachers address the needs of pupils exhibiting maximum contrasts in emotional intelligence, statistics were applied to decision-outcome data for pupils defined as either High-EQ or Low-EQ. The first decision-outcome variable defined teacher assignments of pupil workgroup size. An inspection of the collaborative and non-collaborative assignments for female and male pupils representing the EQ extremes revealed a high degree of uniformity in assignments. Overall, 34% of the pupils were assigned to work alone, 51% were assigned to work with one other pupil, and 15% were assigned to work with two to three other pupils. The remaining three decision-outcome variables were submitted to 2(Teacher group) by 2(Pupil EQ level) by 2(Pupil sex) analyses of variance. The first two variables addressed lesson activity assignments. For information reception, a significant main effect for sex ($F(1,21) = 4.33$, $p = .05$) translated into female pupils, as compared to male pupils, being assigned proportionately more activity time during which they would receive information from the teacher. For project assignment, the second activity variable, a significant main effect for EQ ($F(1,21) = 4.31$ $p = .05$), translated into High-EQ pupils being assigned proportionately more project-oriented activity time than Low-EQ pupils. A significant EQ main effect resulted from the final analysis of variance applied to the decision-outcome variable that defined the time teachers planned to work with individual pupils, $F(1,21) = 14.30$, $p < .01$. Teachers committed a significantly higher percentage of their time to working individually with Low-EQ pupils than with High-EQ pupils.

Simulation Evaluation Variables

Figure 1 illustrates the three onscreen simulation-evaluation items.

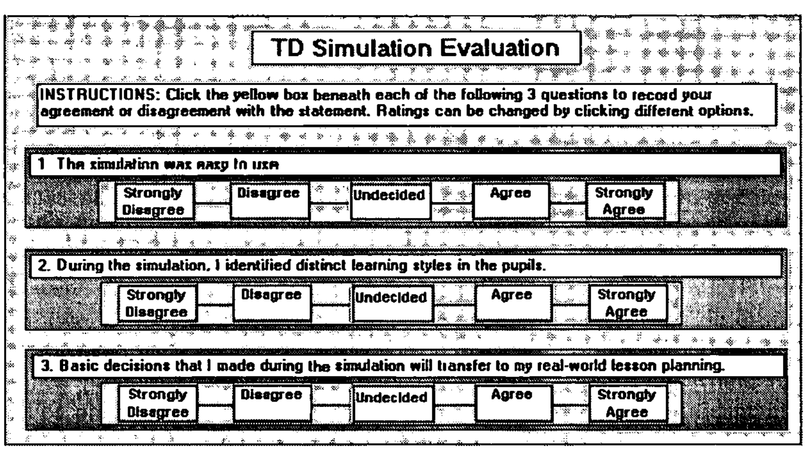

Figure 1: End-of-session Onscreen Questionnaire

Regarding the first question, 75% of the teachers assigned to the non-collaborative group and 82% of the paired teachers reported that the simulation was easy to use. A *t* test applied to the rating data yielded no significant across-group difference. Inspection of the ratings for the second question revealed that 67% of the teachers working alone and 73% of the teachers working with a partner identified distinct learning styles in their pupils as they completed the simulation. A *t* test yielded no group effects. Inspection of the ratings for the third question revealed that 33% of the non-collaborative teachers and 82% of collaborative teachers believed that basic decisions made during the simulation would translate into future real-world lesson planning. The results of a *t* test confirmed that the group ratings were significantly different, $t(21) = -3.47, p < .01$.

Summary and Conclusions

The results obtained from the three variable categories offer several practical suggestions concerning the efficacy of allowing preservice teachers to self-administer the lesson-planning simulation. First, post-participation ratings indicate that the majority of participants found the instructions easy to follow. Ratings and planning decisions also reveal that a majority of the teachers were able to identify the uniqueness of their pupils and were able to construct customized learning experiences for them.

The convergence of several findings, however, suggests that the opportunity to work with a colleague offered distinct advantages. These advantages center on the finding that, teachers working alone, compared with those that collaborated with another teacher, displayed a more conflicted navigation pattern as they completed the planning phase of the simulation. Non-collaborative teachers were less likely to navigate systematically as they completed the planning phase, were more likely to change both pupil location and lesson-activity decisions, and were less likely to tap valuable planning information resources consistently. Group similarities in estimates of the simulation's ease-of-use, in estimates of identification of pupil learning-styles, and in lesson-planning outcomes for individual pupils suggest that the conflicted navigation pattern in non-collaborative teachers did not result from their lack of understanding as to how to use the simulation. One important group difference provides insight as to the potential origins of the first group's more pronounced conflicted-navigation pattern. Participants working alone were significantly less likely to believe that decisions, which they made during the simulated planning, would transfer to their future planning in real classrooms. This finding, coupled with anecdotal pupil comments gleaned from discussions during follow-up debriefing sessions, suggests that the conflicted navigation pattern resulted from the non-collaborative teachers' ongoing uncertainty as to the correctness of their planning decisions. Teachers in the collaborative group had the distinct advantage of sustained feedback-rich dialogue with a colleague. This mutual-feedback effect appears to play out particularly well in the simulated lesson planning which offers a wide array of choices and no clear-cut correct responses. It also appears to play out well when the learning task is self-administered by participants, not by professors or teaching assistants who might provide the supportive feedback that distinguishes the collaborative from the non-collaborative conditions. While this pilot study must be replicated, the present findings suggest that educators consider the potential benefits of collaborative learning not only for simulated lesson planning, but for any complex learning experience that involves a high degree of learner choice and a minimum of right-and-wrong answers.

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SOCIAL STUDIES

Infusing Technology in Elementary Social Studies Methods

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Abstract: This paper discusses the need for university faculty to effectively model appropriate and engaging uses of c omputer technology in teacher education courses. Preservice teachers need experience implementing meaningful ways to use available technologies in preparation of lessons and activities. Specific reference to infusion of technology in elementary social studies methods is explored through four methods course assignments which include software analysis, Internet site analysis, multimedia project creations, and website development. Findings indicate that overall, the students in this course evaluate themselves as competent in use of technology in the social studies content areas.

A Universal Problem:

While preservice teachers may be adequately trained to select software and hardware in introductory computer literacy courses, they seldom are provided the chance to plan or practice presenting lessons using their selections (Byrum & Cashman, 1993). Most preservice teachers receive less than 20 hours of hands-on computer training during their education (Glenn & Carrier, 1989). This training typically consists of mechanics of operating hardware and selected software applications in a required stand-alone computer technology class. The course focus becomes one of acquiring basic skills using basic tools rather than purposeful integration of technology in the curriculum content areas. Even with carefully designed computer courses in schools of education, only 29% of education majors felt prepared to teach with computers (U.S. Congress, 1988). While this study was conducted a decade ago, progress to optimally prepare America's preservice teachers to meaningfully integrate technology in curriculum content areas has not been fully realized (Brownell, 1990; Diem, 1989; Kerr, 1990; Shore, et al, 1990).

In addition to limited opportunities to implement technology in curriculum content areas, preservice students have few models provided at the university level. While many colleges of education require preliminary courses on basic computer literacy, too few teacher education programs have faculty who are modeling instructional methods that integrate computer technology (Handler & Marshall, 1992; Office of Technology Assessment, 1995). Teacher training programs must recognize the need for training in technology, taught across the curriculum. While scholars have advocated integrating technology in both methods and foundation courses (Berger & Carlson, 1988; Billings & Moursund, 1988; Bitter & Yohe, 1989), coursework needs to be redesigned to integrate technology within courses so that computers are used in relevant contexts. Computer technology should facilitate content learning from carefully designed course goals and

objectives that are developed using appropriate technology-based activities and practices (Todd, 1993).

Preservice teachers learn to teach the curriculum by using technologies they have learned or observed being modeled in their college classrooms. Without influencing role models in methods courses, preservice teachers are deprived of opportunities to witness examples of teaching with computers (Bruder, 1989; Fulton, 1989). According to Wetzel (1993), most college professors simply do not use it, despite accepted competencies indicating that education majors should learn how to use computer productivity tools for effective instruction.

The International Society for Technology in Education (ISTE) and the National Council for Accreditation for Teachers (NCATE) have established Foundation Standards that require competencies to use and evaluate computers and related technologies. Learners must operate software, multimedia and hypermedia, and telecommunications to support instruction. They must demonstrate skills in productivity tools for personal and professional use, understand equity, ethical, legal, and human issues related to technology; and stay current in educational applications of computers and related technologies. In spite of ISTE/NCATE Standards first initiated in 1991, many universities have not adhered to these guidelines nor have they taken leadership role in this movement (Wilson, 1995).

Even when promising new teachers begin their first teaching positions, their use of computers in the classroom is not what they had anticipated. Beginning teachers embark on their new teaching assignments with expectations to apply newly acquired computer knowledge and skills in their classrooms. Yet the complexities of surviving the first year teaching with new content, materials, resources, and classroom management leaves little energy for using computers in teaching and learning. Overwhelmingly, new teachers feel constrained by lack of time which inhibits technology integration in lessons and activities (Novak & Knowles, 1991). Even experienced computer-using teachers require five to six years to develop a framework for effective use of technology in teaching (Sheingold & Hadley, 1990).

This poor response to technology may be influenced by the fact that many college of education faculty lack the requisite skills or experience to model teaching techniques using computers in their areas of expertise. One suggestion includes higher education faculty infusing technology into the goals and objectives of the course content. In elementary social studies methods at Iowa State University the following technology plan was implemented.

An Infusion Solution in Social Studies Methods:

Electronic Communication: Approximately 30 preservice teachers file in the assigned university classroom for their first day of social studies methods. Like many college students they thumb through the new syllabus evaluating just how much "work" this

class will require and how accountable they will "have to" become in order to not compromise their current grade point average. On that first day, they must provide their e mail address and phone for the class composite and try to smile as I circulate taking photographs of them using my Sony Digital Camera. They quickly learn that technology is important in this class. They will receive relevant class announcements and exam study tips via group e mail. Exemplary Internet sites will be shared through their e mail. Electronic communication of their ideas in response to viewing a video from the "National Women in History Project" or "Winning at Teaching" when their instructor misses class to present at a national conference is required. In fact, student opinion is enhanced when forwarding an e mail response to the video. I hear from 100% of the students, as opposed single individuals who volunteer in class discussion after a whole class video viewing. Students learn e mail is an efficient way to contact a very busy instructor who manages to checks e mail messages several times daily.

Electronic Presentations in Class: The entire social studies course is presented on a Hyperstudio® stack outlining the required texts and materials, attendance and grading policies, course assignments, field component, and National Council of Social Studies (NCSS) Standards. After using a laptop and an LCD panel to introduce the course, this program is loaded on the hard drive of the education department computer lab "classes" file for perusal when students are preparing social studies assignments. PowerPoint® is used judiciously for class presentation of research and text material. Rather than using Power Point® as electronic overheads, discussion prompts and cooperative group tasks are included in the electronic presentation. By the second day of class, a new Power Point® contribution with each students' digitized photo along with their name is ready to present. All students learn better when they are recognized and valued. Calling students by name on the second day of class is a powerful way to include them in meaningful interactions.

Computer Software Analysis: Because students may have already had a steady diet of drill and practice software, one of their first assignments is to analyze interactive, engaging software for a grade level of their choice. Not only do we have class demonstrations for selecting and evaluating software for content relevant purposes, but students select four of their own software selections to analyze. Our department CTLT (Center for Technology in Learning and Teaching) laboratory has an excellent software collection, but cannot purchase every new software piece on the market. Therefore, I have found making requests to commercial software vendors, who want their software analyzed by our preservice students, to be a valuable investment. Some software must be returned to the company within a 90-day period, other demoware is ours to keep. Students evaluate software for the NCSS strand, teacher/student usability, user interaction, content development, instructional value, record-keeping ease, assessment capabilities, and modifications for a range of intellectual abilities.

Internet Challenge: Navigating the WWW for social studies sites begins by scanning my -"100 Best Websites for Teachers" (see http://www.public.iastate.edu/~sbeisser). Students locate 5 well-selected sites for teacher or student use. They evaluate those sites for NCSS strand connection and importance to understanding geography, history,

economics, political science, sociology/psychology, or current events. Students analyze attributes of the website and the potential to invite higher level thinking. Lesson plan ideas for a specific grade level or purposeful staff development uses are described for each site. At the end of the assignment, summary statements must be outlined providing 5 good reasons for Internet use in school and 5 thoughtful cautions regarding use of the Internet in the educational setting.

Multimedia Project: As a final project in the course, students may complete one of four major projects: A theme unit, an interactive learning center, a multimedia project, or a social studies website. Students may work collaboratively or independently on their final projects. There are revolving due dates for project completion and presentation in class. Students are encouraged to learn from each other and to try new skills. If they have never developed a multimedia presentation using Hyperstudio® or authored a webpage, now is the time to start. The multimedia project must focus on a social studies content area and address one or more of the NCSS Standards. Their multimedia project should include use of a map or globe, user interaction, thoughtful use of sound, text, graphics, animation, and have clear navigational guidelines. It must have an assessment component, a bibliography of sources, and modification for a range of intellectual abilities. The multimedia project should stimulate the user to think critically, respond reflectively, or react creatively.

Website Design: This assignment is to encourage students to move beyond a typical homepage displaying their resume, personal interests, and pets. The social studies website needs to connect to the NCSS Standards, engage the user in social studies content, and invite higher level thinking. Additional considerations might include website layout, text, color, graphics, sound, video, hotlinks, user navigability and interaction. There must be a way for user feedback and site visit counts. Variation for both capable and novice WWW users must be incorporated. A bibliography of credits and citations must be available in hard copy or online.

Responses from Preservice Teachers:

University students prefer taking responsibility for their own learning by self-selecting relevant assignments, reasonable due dates, and choice of group membership. Infusing technology in social studies content with the NCSS National Standards was a weekly practice, not a novel or contrived assignment. Commitment to use technology continued into their student teaching practice, according to informal communication from these methods class members. Student comments from end-of-the-semester social studies methods course and instructor evaluations were encouraging.

"I now have a goldmine of great social studies Internet sites from our whole class assignment to analyze websites. You usually don't get to benefit from everyone else's work."

"I learned more from this methods course than any other about how to create a meaningful webpage. I was the only female who wanted to create a webpage. At first the guys took over, then they realized I had both the interest and the skills to work on this project. We had neat hot link connections to Service Learning sites from all over the country. I really liked the service initiative in social studies education."

"Although I had never actually created a Hyperstudio® project before, I had a great partner, who was very patient and instructive. Working in a pair as we created our multimedia project on Inventions, allowed us to do our own research and to create a cool activity for 5-6th graders. We'll be able to use this in student teaching. We spent hours and hours on this, but the time flew by quickly. We were proud to present this in our methods class."

"Teacher educators will do well to model the use of computers in instruction so as to provide realistic examples from which these future teachers can later build" (Novak & Knowles, p. 49)

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Promoting Powerful Social Studies Teaching

and Learning through the use of Technology

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In this paper we will discuss the Social Studies component of the Impact Grant, a multi-year grant to develop content-specific applications of technology in teacher education. We believe that effective integration of technology into the social studies can better promote the goals of education in a democratic society by making learning experiences more active and authentic and by promoting critical thinking. Examples of the materials we have been developing based on this premise are presented in this paper along with plans for evaluation and dissemination of these materials.

Introduction

In 1997, the President's Committee of Advisors on Science and Technology concluded that:

> the nation's substantial investment in hardware, infrastructure, software, and content will largely be wasted if K-12 teachers are not provided with the preparation and support they will need to effectively integrate information technology into their teaching.

The Committee's recommendations include a focus on preparing teachers to use technology to facilitate learning within their content areas rather than on preparing teachers to teach about technology.

Likewise, the White House convened an invitational conference on technology and teacher training on April 24, 1998 to highlight the importance of technology training for teachers. The National Economic Council has observed that "helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realized."

The goal of the Impact Project is to facilitate and accelerate change in the nation's teacher education programs, encouraging university faculty to incorporate appropriate uses of technology in teacher preparation programs. The Impact Project promotes appropriate uses of technology in specific content areas. The first phase of this multi-year initiative addresses secondary math and social studies.

In this paper, we will discuss the Social Studies component of the Impact Project including (1) our rationale for infusing technology in this content area, (2) the modules being developed as part of this project, and (3) our evaluation and dissemination procedure.

Rationale

Effective integration of technology into the social studies can better promote the goals of education in a democratic society by making learning experiences more active and authentic and by promoting critical thinking.

Active Learning
When students have active and personal experiences it strengthens their understanding of the given topic. Active learning is advanced when teachers and students use technologies such as telecommunications (Barr, 1994; Boldt, Gustafson, and Johnson, 1995). When students communicate with other students or with experts as part of a problem solving or critical thinking activity, they are in control of their learning experience. Instead of reacting to teacher directions, communication technology gives students some control over their learning. (Berenfeld, 1996). This constructivist approach encourages student activity and motivation (Maskin, 1996; White, 1996; Wilson and Marsh, 1995).

Critical Thinking
Citizenship in a democracy implies critical thought, and critical thought requires information (Parker, 1991). Technology can make more and different types of information available to students. The Internet, in particular, has the ability to dramatically increase information and resources available to teachers and students. Technology has increased not only the availability of primary resources but how students and teacher are able to interact with them. Along with the Internet, spreadsheets and database applications allow students to manipulate information in a critical manner. When used appropriately these tools can help teachers assist students in critical analysis.

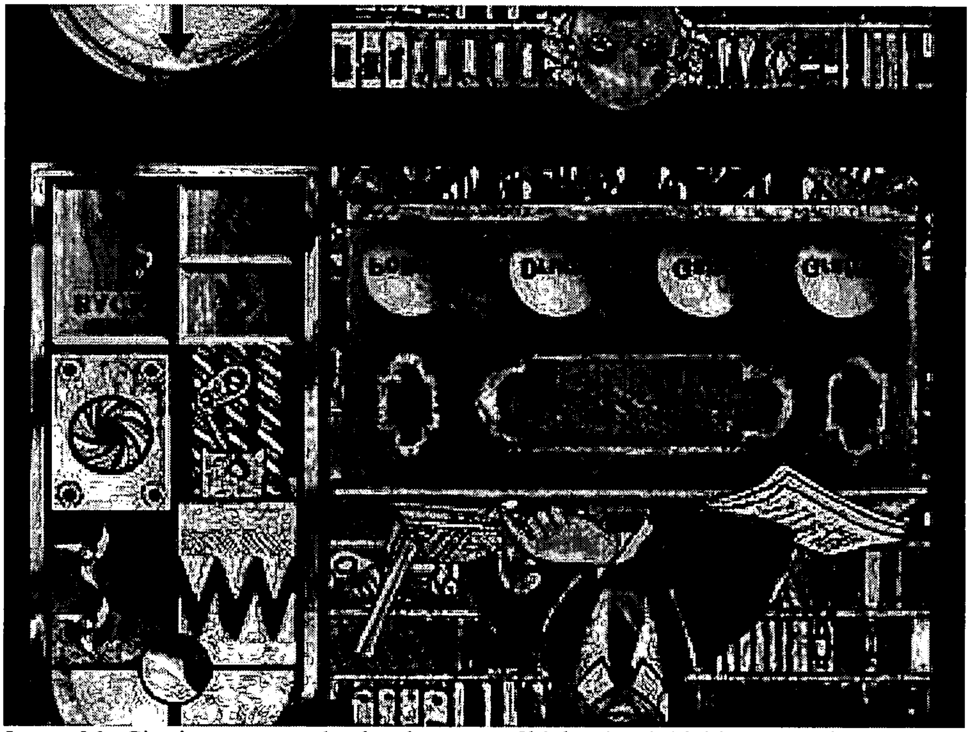
Authentic Learning
Technology offers a new way to authentically represent American society in students' lived experiences (Tally, 1996). Using the Internet, students can interact with peers from different cultures and with experts in specialized fields. Using technology, students can produce collaborative reports, gather, share and manipulate data and create knowledge that can be used by others. Such collaborative learning experiences are not reproductions of the real world, they are the real world. Students are developing knowledge and technology skills they will use as adult citizens. The contributions they make through conversations or shared work are very real and have the potential to impact other people.

Modules
The initial phase of the Impact Project includes both the creation of technology-infused modules and the identification of existing software that can be used to enhance social studies teaching and learning. The intended audience for these modules is social studies methods instructors and their students. It is our objective that methods instructors will use these modules to model effective social studies teaching strategies in their methods courses. We are making concerted efforts to develop modules for each of the disciplines within social studies (i.e. history, geography, economics, etc.). Additionally, we are including a variety of the technology applications used in the social studies.

Module Example
The following modules represent various components of the implementation process of the IMPACT project. The first module exemplifies the integration of existing simulation/ learning game software into the social studies classroom, specifically a sociology or government course. The subsequent module demonstrates the development of new technology materials to facilitate instruction across content areas.

The identification and selection of quality software materials can be a confusing and overwhelming process for classroom teachers who are bombarded with catalogues and images of new titles. Through the IMPACT Project, we have identified quality software products that exemplify how technology may be used in the social studies curriculum.

The program My City (1997) is a simulation program that may be utilized in sociology or government courses. It focuses on decision-making skills and encourages social awareness by engaging students in simulated community actions. Students serve as the elected mayor for a fictional city. They attempt to respond to a series of issues impacting their city and participate in identification of problems, brainstorming of possible solutions, research and consultation with experts, identification of resources, selection of a course of action, publication and dissemination of opinion articles, and evaluation of their decisions. The objectives of the program are for the players to remain in their elected position by retaining their financial resources, volunteers, and popularity rating throughout the game.



Just as My City incorporates the development of higher level thinking strategies by engaging students in playing an interactive, animated simulation/ computer learning game, the following module fosters students' critical analysis skills through the use of spreadsheets. The lesson entitled "Using a Spreadsheet: Social Demographics and Presidential Elections Statistics" focuses on social demographics and voting patterns in Presidential elections from 1952 - 1976. The objectives of the lesson include the (1) identification of data contained in a spreadsheet, (2) the creation of a spreadsheet of presidential election returns, (3) the development of skills to use the Microsoft Excel program, and (4) the identification of voting patterns among African Americans.

Students use preestablished data to create a spreadsheet file. The table below displays a portion of this data which represents responses to surveys conducted by the National Election Studies. All numbers are percentages of the total number of votes cast by people in the demographic category. For example, in the 1952 election fifty-one percent of grade school educated voters voted for Eisenhower (R) and forty-nine percent of grade school educated voters voted for Stevenson (D).

	1952R Eisenhower	**1953D** Stevenson	**19656R** Eisenhower	**1956D** Stevenson	**1960R** Nixon	**1960D** Kennedy
Grade School Ed.	51	49	58	42	44	56
High School Ed.	57	43	56	44	47	53
College Education	73	27	69	31	64	36
Urban	50	50	55	45	40	60
Suburban	62	38	64	36	56	44
Rural	61	39	60	40	53	47
Males	57	43	56	44	48	52
Females	59	41	63	37	53	47
Whites	60	40	61	39	52	48
Blacks	20	80	36	64	29	71
Protestant	64	36	64	36	63	37
Catholic	48	52	54	46	17	83
Jewish	28	72	23	77	11	89

Students are asked to create a spreadsheet and various charts of the information displayed above. (Note: graphing calculators may be used instead of spreadsheets). They then calculate averages, explore variation in voting from year-to-year and generate hypotheses about what social and political events may have influenced voting at particular points in history. For example, students may be asked to hypothesize why African-American voting patterns changed from 1952-1976 or to compare the percentage of votes cast by people living in urban areas for Democratic candidates for president from 1952 - 1976. They may also be asked to present this data in a variety of graphic formats and discuss how data presentation is influenced by what one wants to portray.

Both of these modules can be done with multiple computers or using cooperative learning groups with one computer. Assessment activities are varied and can include narrative responses and application to other time periods. Complete versions of these and other modules may be found at:

Evaluation and Dissemination

One of the goals of this effort is determining if Project Impact has a positive effect on social studies teaching and learning. Year One of the Impact project was spent developing modules for use by social studies methods instructors. During the current year, these modules will be field-tested by methods instructors at four universities and by K-12 teachers. Seven new methods instructors will be added in Year Three to expand evaluation and dissemination. After the modules have been tested and evaluated they will be made available to methods instructors and teachers on both CD-ROM and on the Internet.

The effect of the modules as they are used in social studies methods classes is of utmost importance. Initial studies will look at the measurable effects on students and their exposure to the modules. A focus on measuring or controlling such factors as student and instructor aptitudes toward technology and teaching styles as they are effected by using the modules will be at the heart of this evaluation design. The following will be considered in the evaluation process:

- How instructors used the modules in their social studies methods classes.
- Whether instructors were able to effectively implement the modules into existing methods courses. We will determine whether instructors are able to use these modules to model technology-infused teaching strategies in the social studies.
- The achievement and performance of preservice students who use the modules in their social studies methods classes. This will be demonstrated by students charting their experiences with the modules and will be accomplished in a bimodal format. One of these will be through traditional academic performance measures. The other will focus on the incorporation of demonstrated teaching techniques amenable to the use of technology in actual classroom situations.
- Gains in the technological sophistication, expertise and application by instructors and students using the modules. This will be accomplished through pre and post testing of technological skills in the content areas.
- Changes in attitude toward technology by both instructors and students. This will be accomplished through the use of pre and post attitude scales and interviews.
- Effects of the modules on secondary social studies K-12 classroom environments. This will be done through interviews with selected teachers who have used the modules in their classrooms.

Conclusions

Preservice teachers experience little modeling of effective technology integration from their methods instructors (White, 1996). It is our intent that social studies methods instructors and classroom teachers alike will have the opportunity to learn and enhance their technology skills and teaching skills by using the Project Impact modules. Methods instructors who model technology-infused teaching practices for their preservice teachers hold the potential of positively effecting not only how these students will teach social studies in their own classroom one day; but they also hold the potential of positively effecting the way our K-12 students learn.

It is hoped that educators, in other content fields, will also avail themselves of the template developed for these modules. This will be made available through the Project Impact Internet Web site:

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Social Studies Teachers and Technology: Activities for the Constructivist Classroom

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Abstract: Reform efforts in the social studies have stressed a need to change the manner in which social studies has been taught and learned including role-playing, simulations, and other activities that go beyond textbooks while involving students in critical thinking, problem-solving, and decision-making. One especially effective way to actively involve students in these activities is to incorporate technology into the social studies classroom. This paper provides information activities developed in an attempt to integrate technology into the social studies curriculum while at the same time, encouraging skills such as critical thinking, problem-solving, teamwork, collaboration, creativity, and providing experience in using various types of technological tools.

Introduction

Over the last several years, teacher education and teaching methodologies of classroom teachers have been criticized by many groups, organizations, and individuals. One response to this criticism has been the use of constructivist learning principles in teaching. Constructivism holds that children learn in the context of culture and social interaction and that teachers should act as facilitators, helping students to construct their own understandings (Brooks & Brooks 1995). Many recent reforms in education which have supported active approaches to learning to replace traditional methods, especially those based on rote memorization have adhered to constructivist principles. It is suggested that students should construct mental models of work, so the more they interact authentically with the world, the more they will learn. Vygotsky's theory of social constructivism also requires an active teacher who acts as a facilitator and guide, not as a lecturer (Vygotsky 1986). Further, a the teacher's knowledge of the textbook content, while important, is insufficient, alone, to promote higher achievement because students must actively participate in a wide range of learning activities.

Subsequently, "constructivist trends in education have increased social studies educators' awareness of effectiveness of curriculum that engages students in learning-by-doing, problem solving, and decision making" (Fontana 1997, p.1). Reform efforts in the social studies have stressed a need to change the manner in which social studies has been taught and learned (National Council of the Social Studies 1994) including role-playing, simulations, and other activities that go beyond textbooks while involving students in critical thinking, problem-solving, and decision-making. "It is thus vital that curricula, and in particular the social studies, be designed to help students develop the intellectual skills that lead to knowledge acquisition and its application to problem solving and decision making" (Fontana 1997 p. 1). An especially effective way to actively involve students in "authentic problem-tackling or decision-making contexts" is to incorporate technology in the social studies classroom (National Council for the Social Studies 1994, p. 165). Learning to access and utilize technology will assist students as they enter a world where their jobs and personal lives necessitate the acquisition, evaluation, and maintenance of information, and the ability to interpret, communicate, and process information by means of technology (Wilson 1997). White (1995) asserts that social studies education has lagged behind the other disciplines in integrating technology into the curriculum and suggests that the constructivist approach can address this weakness.

Recognizing the need for changes in instructional practices in the social studies classroom, teachers are integrating technology into the existing social studies curriculum to promote collaboration, problem-solving, construction of knowledge by students, having learning occur in meaningful contexts, and relating learning to students' own experiences. Such practices attempt to reduce reliance on textbooks and teacher talk and instead giving students the responsibility for negotiating the acquisition of social studies knowledge. Integrating technology with constructivism into instruction is not a simple task for these teachers. Aside from the technical aspects of using equipment, software, and trouble shooting, the instructor must be able to "launch and orchestrate multiple groups of students, intervene at critical points, diagnose individual learning problems, and provide feedback" (Means & Olson 1994, p. 18). While teachers may create authentic learning tasks without computers, and activities may move away from didactic, teacher-centered activities, computer technology can augment this process (Dwyer 1994).

This presentation will provide participants with the activities of secondary social studies teachers who have successfully integrated technology and constructivism into their classrooms. The activities were developed in an attempt to integrate technology into the social studies curriculum while at the same time, encouraging skills such as critical thinking, problem-solving, teamwork, collaboration, creativity, and providing experience in using various types of technological tools. How to implement and assess the activities will be described, as well as how they relate to constructivism. In addition, student perceptions of learning by integrating technology and constructivism into social studies classrooms will be discussed and will provide insights into the impact of integrating technology and constructivism in the classroom.

Activities

News Broadcast

In an attempt to integrate technology, one social studies teacher developed his world events class as a totally technology-based course. As a model for the students, he initially used a variety of technological resources (e.g., computers, digital and video cameras, flatbed scanner, television, VCR, Internet, cable, multimedia projector, and presentation software) in his own teaching. He then provided instruction in basic computer skills and modeled the news broadcast for the students. When the students began their projects, the teacher served as the facilitator, shifting the focus of instruction to the students for the projects. Each world events class was divided into groups of four with the suggestion that each group select a leader who was proficient with a computer and possibly had Internet access at home. The team members took turns each day watching CNN as well as other news programs. The team members then brought the news stories for that day to the group. As a group they decided on a story to use for their news presentation. On Wednesday of each week, the students went to the Internet Lab in the Media Center where students would gather additional information for the news presentations. Two of the team members conducted research, while another two developed a *PowerPoint* (Microsoft) presentation (any presentation software can be used). Once information was completed in the *PowerPoint* format, students used the VCR, video camera, and scanner to develop the multimedia presentation for the class.

The presentation format was similar to an actual news broadcast. Using a "news desk" in the classroom, the news anchors, with the aid of a multimedia presentation projected on a screen behind the

desk, delivered a newscast. The newscast included local, national, and international news as well as segments on sports and weather. The room was darkened, except for the light on the newsdesk so that the focus was on the news anchor and the multimedia presentation. A podium with an attached light was placed on one side of the room for additional reporting. During the weather broadcast, the broadcaster stood by the screen and used a pointer to deliver the weather forecast. Students viewing the presentations were required to keep a news journal where information from the news stories presented was recorded and could be referred to in future class discussions. The presentations were graded using a rubric which included technical, content, group dynamics, and presentation elements.

Internet Field Trips

The Internet has the potential to serve the classroom teacher in a variety of ways, many of which are only now being fully explored. One promising use relates to Internet field trips. Many factors, such as restraints on time, lack of adequate funding, and monumental distance, often make literal field trips prohibitive. Though there is no substitute for actually visiting sites such as the National Archives or Washington's Mount Vernon, "traveling" via the Internet to such places of historic significance assists in providing the social studies student with rich and meaningful educational experiences. Additionally, visiting a site via the Internet prior to physically traveling to a location serves as a valuable method of introducing concepts relative to the field trip destination. Planning is essential to the development of a sound "virtual field trip" experience. A close examination of all sites that are to be utilized in the classroom environment should be conducted by the teacher prior to embarking upon the "virtual highway" with students. There are literally thousands, possibly millions of web pages that may be accessed via the Internet, unfortunately many of these are poorly constructed and/or inappropriate for children. Internet sites should be previewed just as the responsible teacher endeavors to preview videos, films, books, and other resources prior to incorporating them into classroom situations. In addition to ascertaining the appropriateness of the content of a particular web site, teachers should "visit" the site in order to prepare an Internet Travel Guide for each web site that is to be visited.

An Internet Travel Guide should provide basic directions to students beginning their journey into cyberspace. Typically, the Internet address for the site that is to be explored should be clearly written at the top of the page. Assuming students have prior knowledge relative to the use of an Internet browser, they will know that this address must be typed in exactly as it is written. It is always helpful to remind students to be exact when entering web addresses. If your school is fortunate enough to have a web site, you should consider constructing a Links Page to assist in accessing web sites.

The Internet Travel Guide should also include directions for touring a web site. Many web sites are quite intricate, and if the students are left to their own devices, they may spend a great deal of time on less valuable tasks, such as determining the proper pages within the site to explore. By providing students directions as to where to begin their exploration of a particular site, the teacher is providing the student with a "nudge" in the right direction. The Internet Travel Guide should provide students with questions that may be answered through a close examination of the site. The age and ability level of the children involved will prescribe the types of questions that are asked. Additionally, teachers may choose to incorporate drawing activities in their Travel Guide to engage the more kinesthetic learners in the group. For example, on the *Destination: Jamestown* travel guide that was used with eighth grade students, the students were asked to discuss the importance of building a fort at Jamestown, then they were asked to draw the fort based upon the descriptions and pictures that were provided at the Jamestown Internet site.

Many web sites actually provide an interactive, online quiz. These quizzes provide immediate feedback to students as they tour the site, and are an excellent way for students and teachers to examine what learning is actually taking place via the Internet field trip. One such site that provides this opportunity is *George Washington's Mount Vernon Estate and Gardens* Students are provided the opportunity to take the Mount Vernon On-Line Quiz. After completing the quiz, students learn which questions they answered correctly and which were answered incorrectly. The quiz is timed, and if all answers are correct, the student has the opportunity to enter his name in the Hall of Fame.

The students can keep a travel journal as they take their field trips, making notes about the sites they visited (e.g., the main points of the site, why they selected that particular site). Student assessment can include: Explanation of sites selected, Criteria for selection, Cohesiveness/sequence of the sites, and Partner evaluation. Though there is no substitute in the school environment for visiting historic places, the

Internet provides a unique opportunity to introduce students to places that might otherwise go un-experienced. Also, Internet field trips enhance instruction because they give students the opportunity to work in cooperative groups and discover their own meanings as they explore the field trip sites and related sites. As Internet use becomes more common, and more sophisticated, interactive learning experiences via the computer will become more commonplace in classrooms.

Traveling Through Foreign Countries

For this activity, students were divided into groups of five and asked to plan and research a five-day journey through several countries, using geographic, economic, and political information about the areas through which the students would be traveling. The teacher had developed various journeys in advance. Students selected different journeys, randomly. Then, the students decided that they needed information on a variety of topics, such as customs, languages, foods, water, and weather conditions that they would encounter on their journeys. The students located information on the Internet, e-mailed individuals from other countries, used available software such as Microsoft *Encarta* and searched other resources. Once students gathered and then synthesized information, they developed an itinerary for their trips. Then, using Microsoft *Powerpoint*, the groups prepared multimedia presentations. The presentations consisted of information (e.g., weather, land topography, customs, etc.) about each country as they traveled through it onscreen and included music, pictures, and videos. The presentations were projected onto a screen with an LCD panel (an attachment which projects the computer images onto a television screen is a less expensive alternative). Students viewing the presentations were asked to record the information from the presentations and develop a travel journal for future trips. This activity required the students to work cooperatively, use research skills, use map skills for tracing their journey, employ critical thinking skills to develop the journey description, and utilize technology and multimedia as a method of research and presentation. Variations on this activity could include traveling through different times in history.
Assessment for the activities included several areas: Data collection, Sources searched (a minimum of five was required), Presentation (technical aspects, oral presentation), Group member assessment.

State Web Pages

Students were divided into groups of three to four students and the groups were told to select a particular aspect of the state in which they live, conduct research using a variety of sources, and then create a web page presenting the information. Various topics the students selected included recreation areas, famous people from the state, state government, and state culture. The students used various methods for collecting data including searching the Internet, conducting personal interviews, researching newspapers, contacting the Chamber of Commerce, taking photographs, and using E-mail. The students took the information they collected and used it to create web pages displaying the information. The web pages were created using Microsoft Works and HTML codes and included text, video, audio, digitized photographs, and some animations. While the students were working on collecting data and creating the web pages, they were told to keep a journal, detailing their activities and reflecting on what they found. Assessment of the web page development activity consisted of presentation, content, research, group dynamics elements, and reflection. The reflection assessment involved an examination of the students' journals. This activity had several benefits for the students including involvement in their state, web page development, relating web page development to their lives, collaboration with other students, and reflection.

Developing a Database

Several projects can be aided by developing a database. For example, in one social studies classroom, students from two different communities were asked to collect information on their community, put that information in a database, and then they were asked to manipulate the data to examine similarities and differences between the two communities. Using e-mail and the Internet, the students collected information about their own communities and then shared that information with each other. Other activities could include assigning a student to research and develop a database of their partner school; using

a database to collect information about leaders of a country throughout various time periods to compare the characteristics of the leaders and how they may have differed; and using E-mail to have students from different communities collect data on some aspect of the community (i.e., history, leaders, community projects), put the data into a database, then analyze and manipulate the data to examine various hypotheses about similarities and differences. The groups could include students from different states and countries, also. Similarly, teachers and students in any content area can use a database project in order to organize and utilize information in their discipline. Database development allows collaboration in problem-solving, construction of knowledge by the students, having learning occur in meaningful contexts, and relating learning to a student's own experiences.

Student Perceptions

At the end of the first semester of the world events classes discussed earlier, students were given a survey to examine their thoughts on the value of using technology in the social studies classroom. After the surveys were completed class discussions were held. Most students felt that technology had been conducive to their learning experience. Their most frequent response was that technology not only made learning social studies more interesting but also had given them the tools (word processing skills, developing PowerPoint presentations, creativity, organizing information and materials, public speaking, etc.) that they could use in college and in the business world. An example of this is one student's statement, "Yes, by having more hands-on experience I have learned many skills. One thing I have learned is how to gather information from many sources and then put it together. I have also learned how the stock market works by keeping track of a stock for several months. And finally I learned how to write HTML." In response to a question about the benefits of the learned technology skills, the overwhelming student response was that they had not only learned about what was happening in the world but had gained computer skills that would help them in college and in the business world. One student stated, "Yes, I plan to go into a career in law enforcement. Some police stations and sheriffs' offices are already using computers and the Internet. I believe this will help me a great deal."

All of the students felt that students should use technology in the lower grades. Some cited that the sixth and seventh grade would be the best place to start, but most felt that it should start at the elementary level, the reason being that students should learn technology skills in the elementary grades since they will be required to use them by the time they enter middle school. When the students were asked how technology could be better used to enhance the learning experience in the social studies classroom, the most common response was the need for more equipment. Since this was the first technology-based social studies class offered at this school, lack of equipment was certainly a problem. Each class consisted of four groups. The equipment that was available consisted of two laptop computers, a multi-media projector, and one multi-media workstation hooked to the Internet. Even though the classes had access to an Internet lab with twenty-five workstations, it could only be scheduled one day a week. This meant that much of the work that could have been done in class had to be completed at home. The students who did not have a computer and Internet access at home were at a definite disadvantage, and many of them had to come to school early or stay late to finish their projects. It also made it difficult to keep students on task because of the shortage of equipment. This problem was helped, during the second semester, when the class received a donation of a multi-media workstation from a local business and many of the students received computers for Christmas.

Conclusions

The activities described above all integrate technology into social studies instruction. To do this successfully each of these social studies teachers developed activities which employed cooperative learning, critical thinking, and creativity. These activities can also be used with any content area to aid in integrating technology. The integration of technology in these social studies classrooms had a positive impact on many students, specifically making the content more interesting and enabling students to increase their learning by developing new skills. When one student was asked to describe how using

technology changed her view of learning social studies content, she explained: "I do not enjoy writing outlines whatsoever—boring! I like to work in groups to find out about others' perceptions and opinions and compare them with mine."

Rather than having the teacher act as the only source of information, student presentations offered the students an opportunity to see what other groups had developed and allowed the students to see additional points of view as evidenced by this student's comment: "The thing that I like most about the individual groups doing the presentations is that we have someone new teaching class each week." As we near the 21st century, the demands on graduates for technology use will be greater. Technology integration is an effective way to teach students skills they will need to function in society. Enhancing social studies instruction with technology also provides an opportunity for students to be engaged and motivated to learn more about social studies.

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Technology, TEKS, and TAAS: Critical Issues for Social Studies Teacher Education in Texas

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Abstract: The issues of the Texas Assessment of Academic Skills (TAAS), the Texas Essential Knowledge and Skills (TEKS), and the integration of technology are dominating social studies education in Texas and are connected in very important ways as they relate to teacher education. Many in our society seem to blindly accept each of these influences as essentials in the social studies education of our children. Critical analysis of these issues must occur for transformative rather than transmissive approach to social studies; and this discussion must first occur in teacher education, both at the pre-service and in-service levels. The paper analyzes the impact of current praxis regarding technology, TEKS, and TAAS on social studies education in Texas. As a result of this investigation, the paper proposes a critical approach to social studies education and to the integration of technology for TEKS and TAAS achievement in Texas schools.

Introduction

Several issues permeate education and schooling in Texas. The Texas Assessment of Academic Skills (TAAS) and the Texas Essential Knowledge and Skills (TEKS) are now dominating most activities in the public schools of Texas. The role of technology in the facilitation of TAAS and TEKS achievement is also a vital issue regarding schooling in Texas. The accountability movement is alive and well in Texas. Teacher education is now being faced with dealing with these issues as professional preparation ensues.

Administrators, their schools, and their teachers are increasingly held individually accountable for TAAS results and TEKS achievement. The death knell is to receive low overall TAAS scores. It has become a competition to end all competition. Administrators and schools within the same school districts are placed at odds simply as a result of a test. Teachers are now finding themselves with various dictates to teaching TAAS skills and documenting TEKS achievement. The role of technology has been to ensure success – TAAS review or practice tests, for example.

The school culture has experienced a transformation as a result of this "accountability" issue. Entire curriculum is being rewritten to focus on TAAS skills and TEKS content. Teaching methodology, recently moving toward a more student-centered, creative focus, is now moving the opposite direction. TAAS worksheets and related activities dominate the classroom. Technology, having so much potential, has been relegated to glorified "drill and practice." The normal school day and week are often thrown by the wayside for TAAS preparation. TAAS games and pep rallies are used to behaviorally encourage teachers and students to focus on TAAS improvement. Covering TEKS objectives (only minimal competencies) are driving curriculum and instruction. Similar issues pervade teacher education with increased accountability with ExCet (the teacher certification exam).

Despite the trend toward standardized tests, there exists a growing body of research critical of its implementation and especially its dominance. Nelson (1993) states that standardized testing does not measure effective skills taught in schools, particularly in social studies and that more authentic assessment approaches aimed at developing critical thinking, decision-making, and refinement of conceptual ideas should be the goal. According to Hardwick (1996), student motivation and learning environment issues definitely affect performance on standardized tests such as the TAAS, with a need for teachers to be more sensitive to affective needs of students. Ivory (1993) documents the cultural bias issues with the TAAS. Another example has the National Council for the Social Studies (NCSS) states in its position paper on testing and evaluation (1991) that standardized tests are biased against persons whose cultures or gender differ from those of the test developers. Many similar criticisms can be made in regard to standards such as the TEKS.

Issues

A test and minimum standards are now the driving force in Texas public school education. And the primary role for technology is to focus on these forces. Many well-meaning educators, professionals, and citizens trumpet the so-called benefits of this testing and these minimum standards. Some of these "benefits" many espouse include the equalization of education standards for all, improvement of public schooling, preparing students for the "world of work," and ensurance of school accountability. The realities of the situation are much different.

Equalizing education standards for all students is one suggested benefit of exams like the TAAS and standards such as TEKS. A very large assumption must be accepted for this to contain any credence. First of all, it must be agreed upon that standardization by its very nature is an equalizing agent. Many studies indicate just the opposite, that standardized tests are inherently unequalizing and often perpetuate the dominant power at the expense of the "other." The same can be said for standards. In other words, socio-economic, ethnicity, and racial issues arise with the widespread application of standardization in the form of instruments such as TAAS and documents such as TEKS. There is a reason why "these groups" do less well with such methods.

If one listens to popular media, our public schools are a shambles, full of incompetent teachers and students who would rather be committing acts of violence against others just for fun. Berliner and Biddle (1995) counter these simplistic generalizations in their book *The Manufactured Crisis*. Proponents of exams like the TAAS state unequivocally that this is just what is needed to facilitate the improvement of public schools. Again, one must understand what these folks mean by improvement. If we are interested in schools being barometers for test-taking abilities and playing only by what are often demeaning rules and regulations, then they are probably right. But if improvement means the development of knowledge, skills, and attitudes for problem solving and critical thinking as active participants in society, then the current emphasis on standardized exams and accountability is not only wrong, it is obscene. And let us not forget the role of technology in perpetuating this practice.

The integration of technology in schools remains a hot topic. The same issues remain regarding successful technology integration including time, training, and funding. We are increasingly witnessing other issues such as web access and censorship, marketing and technology, and technology as savior. Teachers are still struggling with technology availability and application issues in their classrooms. Marketing, rather than what is really best for our kids, seems to be the driving force in technology integration in our schools. Whittle, EMG, and Jostens have all been quite successful in getting their "teacher proof" technology packaging placed in classrooms. Computer companies are also doing a great job to ensure that their computers are adopted by school districts.

We also have the use of this technology as an issue in our classrooms. If the marketing can demonstrate how the technology can affect TAAS and TEKS, then there is often little more the company need to do to convince. The role of technology is now to ensure higher TAAS scores first, and perhaps TEKS achievement second, if it exists at all. Yet another issue finds technology often used as an add-on or reward when the "real" work is completed.

A major issue in teacher education is how to deal with the accountability issue dominating schooling when research and theory often contradict what is presently occurring. Perhaps the best method is to use these issues for problem solving and critical thinking. Teacher education is not only about practice, but how to be an empowered educator. Developing teachers as activists for themselves, the profession, and for their kids may be an important goal in teacher education, especially due to the disempowering practice occurring in our schools.

An Alternative

What then is the alternative? The traditional method of using worksheets and multiple choice tests have little relevance in schools today, except for preparing students for standardized tests. We unfortunately also use very traditional methods for achieving TEKS objectives. The alternative is creative and meaningful student-centered curriculum and instruction. Performance assessment in the form of student developed projects such as books, "History Fair" type projects, multimedia development, simulations, problem solving, and other creative applications are examples of more relevant assessment tools. Portfolios of student work in the form of projects developed is perhaps the most promising. Rubrics can be developed to holistically assess these projects. Performance assessment is a better gauge of whether students know and can do what is important (Nickell, 1997). There is no way to standardize knowledge, skills, and values, which happens to be the point. Humans are not "standardizable." What kind of picture are we presenting when we state the kids must fit into certain molds?

Technology can be such a powerful tool for teaching and learning if truly integrated into student-centered applications. Commercial simulations, project development software (Hyperstudio, Powerpoint), multimedia, the web, and other applications can provide much to a challenging and creative classroom atmosphere. Technology used as centers, whole class, or small group applications assist with the need for variety in our classrooms. Modeling powerful technology integration in teacher education is also a must if we are interested in transforming what is presently occurring with technology integration in our classrooms.

Despite the mythology brought about by the media, government, corporations and school bureaucracy, there is an increasing amount of criticism of TAAS type exams and minimum standards such as the TEKS from all political spectrums. Most of the criticism is being directed at issues previously discussed. A recent article in the Austin American Statesman summarized these issues focusing on its domination and narrow focus (Aug. 10, 1998). Sample quotes follow:

> "Everything that goes into the classroom is based on satisfying the TAAS."
> Bob Offutt (State Board of Education)
> "Our educational experiences are so narrowed by what the test defines..."
> Lowell Bethel (University of Texas)
> "The test was never intended to be used as the end-all for evaluation of schools."
> Ignacio Salinas (Texas State Teachers Association)
> "Businesses have cashed in on the TAAS mania."
> A. Phillips Brooks (Austin American Statesman)

It is time that we take a proactive approach to education in this state and society. Our primary goal should always be, "what is best for our children." Perhaps the best place to begin is by involving the stakeholders more in the decision-making. We do profess to be a democracy after all. Yes, that means moving away from a bottom-down approach to decision-making as is practiced in corporate and bureaucratic America. Why not involve the students and teachers more in educational problem-solving?

Technology, TAAS, TEKS, and Social Studies

Now, what about technology, TAAS, TEKS, and social studies specifically? What we are seeing is the virtual death of social studies education in elementary schools. TAAS is a reading comprehension and mathematics exam for the most part. Social studies is therefore placed on the back burner in many schools, if it is even taught at all. This is especially interesting due to the fact of the existence of the TEKS for all disciplines including social studies. Teachers are receiving directives to replace social studies with TAAS review and preparation. Even social studies specific teachers in elementary schools are receiving directives to forego some of the social studies state mandated curriculum in favor of TAAS review and preparation activities. Social studies teacher education must deal with these issues and provide student-centered and meaningful alternatives.

Many argue that all the social studies needs is to be included in this standardized testing movement for the status and amount of social studies education to improve and increase. No one really knows. What we do know that when and if this occurs, we will buy in like everyone else and just teach to the social studies portion of the test as well. We could certainly spend additional time and space in critically analyzing the traditional focus of social studies curriculum and instruction. How and why would we ever imagine that a very traditional test such as the TAAS would do anything but perpetuate traditional teaching?

The place of technology in social studies classrooms is yet another issue. The role of social studies for the most part remains to ensure transmission of knowledge, skills, and values. Traditional curriculum and instruction dominates the classroom. Technology is rarely used in social studies applications, but can offer so much. Social studies should really be about developing critical thinking and problem solving skills to promote informed and active citizens.

Social studies has always played a secondary role in schools, particularly elementary schools; and now look at what is happening. We are increasingly questioning social ills and their causes in this country, yet the discipline that perhaps offers more than any other in addressing these concerns is being ignored. Perhaps we have a simple answer to these issues, for when social studies knowledge, skills, and attitude development and learning are replaced or become secondary, what else can we expect, but societal ills and concerns.

Issues in Teacher Education

Rarely in teacher education programs does one find much more than the focus of applying theory to practice in the current setting, with practical applications the driving force. Ideas regarding efficacy in the teaching profession, democracy and empowerment, critical approaches to curriculum and instruction, and deconstructing the goals and objectives of education, schools, classrooms, and teachers are generally avoided in teacher preparation. The idea has been to "train" individuals to meet the grand narrative regarding what it is to be a teacher and what the teacher's role is in society. Technology is employed to support this goal. Unfortunately, with the societal, cultural, political, and economic transitions occurring, teachers and their schools have served as scapegoats when society at large is unable to find solutions to these perceived problems and issues. But schools have often bought into this and adapted to fit society's modernist and oppressive focus.

Teacher education institutions must address the issues of accountability in the forms of testing and standards. Critical analysis of the curriculum, instruction, assessment, and management methods employed toward achieving these goals need to be deconstructed in pre-service programs. Ideas for application that deal with the issues of empowering students and teachers, integrating meaningful and challenging curriculum, and developing necessary skills and attitudes for an informed and active citizenry should first be modeled in teacher education.

The integration of technology in social studies education has fit well within the stability, efficiency and effectiveness components of traditional praxis. It has been grounded in scientific and behaviorist paradigms, and really is grounded in this manner, given its rationale within education as assisting in preparing students for the competitive world of work. Many advocates apply technology with the notion that it is neutral and value free and that it can provide answers to educational issues. But as with social studies

education and teacher education in general, we need to also critically analyze the role of technology in social studies education and teacher education.

Examples of issues in technology in social studies and teacher education include: (1) its complex and often unforeseen impact on teaching and learning, (2) it can create and/or exacerbate social issues and changes, (3) its production and use causes ecological concerns, (4) it is often systematically developed, (5) it often is imposing regarding educational goals, (6) its development and use brings up ethical/moral concerns, and (7) it can facilitate disempowerment among students and teachers (Nichols, 1994). Another major issue is the corporate domination and market philosophy surrounding the increased use of technology in society and schools themselves. These issues indicate in the very least that discourse regarding the role of technology and its social, educational, and political implications must occur.

Until only recently, blind acceptance of the "positive" nature of technology in schools has been the party line. Corporate domination of educational technology (including the increasingly commercialized web) almost guarantees this. Perhaps the most espoused rationale for an increased technology focus is the perceived need to maintain competitiveness in the globalization phenomena. As a result of these issues, social, political, and economic concerns arise. The context of technology integration in the discourse of education for democracy and social justice must be addressed.

Prospective social studies teachers are increasingly receiving the "training" regarding educational technology with introductory courses and technology integration in methods and in student teaching. Unfortunately, most of these experiences include only the training for applying technology in the classroom. It is assumed that technology integration is a given and that teachers need only awareness, access, application ideas and technology will eventually address and solve many problems in our schools. Very little emphasis is placed on critical analysis of technology save evaluation of software, and then only superficially.

A critical debate must ensue, and perhaps the place to begin is teacher education. What is the role of teacher education but to empower prospective teachers with the knowledge, skills, and attitudes important in effecting change in the schooling process? Those responsible for teacher education preach the importance of praxis. Critical analysis and reflection are vital components of praxis in education. Again, where better for this to occur than in the social studies?

Conclusions

The accountability movement is not necessarily a bad thing; our reaction to it in allowing it to dominate school praxis and the educational methods applied to "ensure" achievement are the real culprits. Standardized tests consistently evaluate a low level of thinking and their growing use as instruments of accountability encourages schools to emphasize simple, isolated skills over more complex, holistic ones (Longstreet, 1996). Longstreet goes further by describing five arguments that summarize general arguments opposing standardized tests such as the TAAS as accountability measures. These arguments include legitimacy for accountability, the nature of curricular goals and how they are developed, the validity and appropriateness of using standardized tests for accountability, fiscal responsibility, and benefits for students. These arguments basically question the use of standardized tests as a legitimate accountability measure for the good of our children. Similar issues arise regarding minimum standards, technology integration, and the role of teacher preparation.

The contention here is that with all the issues facing our society and the world for the new millennium, more, not less emphasis should be placed on meaningful, student-centered social studies education. Meaningful technology integration and teacher education focusing on empowering teachers can only help in addressing these issues. The over-reliance and dominance of the TAAS and standards like the TEKS only serve those in power and are demeaning to students and teachers. This is not the answer. A much more rich teaching and learning experience for our children should be the goal.

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SPECIAL NEEDS

Computer Technology, Special Needs Students, and the Inclusion Classroom

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Abstract: US Department of Education statistics indicate that there are an increasing number of students with special needs being educated in the regular education classroom. This places increased pressure on the classroom teacher who may not feel equipped to deal with students who have special needs. Technology can play an important role in providing services to these students. At the University of Wyoming Laboratory School there are classrooms where voice to text software is used to help students with learning disabilities in the area of written language. This program is a cooperative venture between the University Laboratory School, the College of Education, the Learning Resource Center, and the College of Education Technology Coordinator to provide assitive technology for students with disabilities in the regular education classroom. It is designed to be used by classroom teachers to enhance the work of students who have disabilities in speech and language.

Integrating Technology into the Special Needs Classroom: Are Teachers Prepared?

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Abstract: As technology advances, the use of computers in special education classrooms has moved beyond simple classroom management tasks–it should be integrated into the child's educational experience. Are teachers being prepared to integrate technology into special education classrooms? Are teachers taught about of how the American Disabilities Act and P.L. 94-142 may effect them? How do the new technologies help the students? This paper intends to discuss current teacher education requirements that reflect the acquisition of skills needed to use technology to teach students with special needs. An overview of assistive technologies, such as devices and Microsoft adaptations will be given. Applications of these technologies will be provided as well. Students with special needs can profoundly benefit from a classroom teacher who has been trained in the integration of technology into classroom learning. The goal is to produce children who will become computer literate and well-educated members of society.

Currently, the use of technology within the special education classroom is often limited to rote practice using games or tasks such as word processing or drawing. It is vital that as educators we integrate technology into a child's curriculum and understanding of the workings of society. As technology advances education, it is important that all persons involved with the education of special needs students strive to merge technology into their everyday activities.

Background

In 1975, the United States Congress passed Public Law 94-142, better known as the Individuals with Disabilities Act (IDEA). The act has forced changes in the way teachers educate children with special needs. IDEA mandates that every child between the ages of 3 and 21, regardless of the type or severity of their disability, shall receive a free, appropriate public education (Heward, 1996, p. 25). One of the major aspects of P.L. 94-142 is that students are to be educated in the least restrictive environment. Often, the environment has been in a resource room or special education classroom. Many state education agencies, Texas Education Agency (TEA) included, is requiring school districts to place special education students into the regular classroom when it is beneficial to the education of the child. Regular education teachers need to be prepared to meet the individual needs of students with all types of disabilities. Recently, the use of technology is being used to meet the needs of special education students.

Learning With Special Needs

Most students with learning disabilities have difficulty learning in the conventional ways. Studies have demonstrated that students with learning disabilities require material be presented in multiple formats multiple times for retention

to occur. "A number of approaches are available to assist students with mild disabilities" (Behrmann, M., 1998, p. 1). "Technology is bursting into the classroom at all levels, as a tool for teachers to develop, monitor, and provide instructions, and for students to access and engage in learning" (Behrmann, M., 1998, p. 1).

The Necessity for Technology for Students with Special Needs

The integration of computers in the classroom has been a primary focus of teaching new teacher a way of implementing technology into the classroom. Using computers in the classroom allows teachers to offer students the opportunity to learn pedagogical material in unique ways. The utilization of technology creates multiple educational opportunities that are useful to students with special needs and is necessary for their education within the regular classroom setting. With many students the use of assistive technology is enabling them to participate in classroom activities outside the realm of special education.

What Are Assistive Technology (AT) Devices?

"The Tech Act defines AT devices as any item, piece of equipment, or product system (whether acquired off the shelf, modified, or customized) that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Behrmann, M., 1998, p. 1). Both high technology and low technology alternatives are available to students. Low-tech devices include pencil-grips, note-taking cassette recorders, picture boards and taped instructions. High-tech devices include optical character recognition (OCR) calculators, word processors, speech synthesizers, and communication devices. These devices make it possible for children who would not otherwise be able to participate in regular education to do so.

Assistive Technology Applied to Instruction

The ultimate goal of the use of assistive technology for students is to enhance instruction and to modify the way in which a child hears, responds, replies, or implements the instructional process. Lahm and Morrissette (1994) identified seven areas in which AT can be utilized for students with mild disabilities. Those areas include organization, note-taking, writing assistance, productivity, access to reference materials, cognitive assistance, and materials modifications. Organization involves teaching students how to organize their thoughts and materials. Note-taking is simple approach to help students effectively organize written material. Writing assistance involves mainly word processing for help with spelling and grammar. Productivity includes the use of calculators, spreadsheets, and databases for work requiring calculating, categorizing, or grouping information. Access to reference materials involves using telecommunications and CD-ROMs to gather and synthesize information in a less distracting environment. Cognitive assistance uses tutorials, drill and practice, and problem solving software as well as reading assistance using multimedia CD-ROMs. Materials modification is made simpler through the use of technology such as video clips, animation, digitized pictures, etc. Materials such as these applied in an instructive fashion make learning more efficient and more hands on allowing for greater generalizations.

Classroom Applications

With computer technology, teacher education students can learn to enhance their lessons by providing various perspectives on information. Multiple formats can be integrated to provide students with a variety of methods for understanding and recalling information. One way teachers can use this technology is by instructing with multimedia, or making multi-sensory presentations. By using assistive technologies such as multimedia or hypermedia in a lesson, teachers can present information visually, audiologically, and textually.

By using widely available programs such as PowerPoint, HyperStudio, or ClarisWorks, educators can appeal to regular education students as well as students with special needs. This new focus is a way of exercising the brain and

keeping students centered on a learning task without the use of straight lecture or question-and-answer periods. These programs encourage students to view learning as fun. Teachers should be aware of the availability of the AT options. They also need to have the knowledge of how and when to use appropriate programs and assistive devices for each child.

Are Teachers Prepared?

Is it possible for teachers to make informed decisions concerning the technological needs of the student if the teacher has not been trained appropriately nor realizes what options are available? Currently TEA does not have any requirements for teacher certification concerning the need of all teachers to be trained in special education practices. Teacher education students are required to take three hours of computer literacy as it is applied to teaching in classroom situations. Topics such as the behaviorist and constructivist integration of computers in the curriculum and the uses of new multimedia software are discussed, but how these may benefit the student with special needs is not currently addressed.

Proposed Changes in Teacher Education

One of the main obstacles of using technology for classroom applications and as a part of education is the apprehension of teachers to learn the technology. Teachers need to realize that AT often makes the difference between a student being successful in the regular classroom and requiring more special education assistance.

Pre-service teachers need to be educated about inclusion and understand the implications for their classrooms. A recommendation is for college/university teacher education programs and education state boards to make observation/special education classroom teaching time mandatory for certification at all levels. A classroom laboratory setting which provides hands-on experience with AT as well as opportunities to assess individual student needs. Exposure of such materials and situations provides future teachers with the base knowledge needed to handle students with special needs in the classroom. Likewise, learning about technology is not enough. Through pre-service teacher education sessions, educators need to be trained on incorporating technology into their classrooms.

Through adequate training, new teachers will be able to integrate technology for all students. The next goal beyond incorporation is motivating these teachers to utilize the computer more often and in unique ways necessary for the learning of all students.

Conclusion

Technology helps students with special needs a greater opportunity to participate in the regular classroom setting. It is the responsibility of all teachers to have the knowledge and background necessary to determine the type of assistive technology that is needed and how it can best be used by the student. Currently, there is no requirement that teacher in Texas have the basic background knowledge of special education and are required little in terms of technology for children with special needs in the classroom. Until the time when changes are made to require teachers to have the knowledge, students with special needs are going to be at a disadvantage in the regular classroom setting.

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Integrating the Internet into Counselor Education

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Abstract: There are numerable opportunities for counselor educators to integrate the Internet into graduate courses as a counseling resource. This article presents a variety of activities that can be integrated into the course curriculum to introduce the Internet, to use the Internet as a source of information, to access electronic sites for networking, to complete assignments, and to become familiar with professional organizations. The examples provided are activities that a junior faculty member has used to integrate the Internet into counselor education courses.

Introduction

The Internet is a source of information. On the one hand, it is a source of information that can be embraced by users as helpful and beneficial. On the other hand, it is a source of information that can be held under scrutiny as unethical and dangerous. The former can be viewed as *resources*; the latter can be viewed as *practices*. The *practices* of Internet counseling have professionals taking sides on a debate as either ethical or unethical. However, viewing the Internet as *resources* provides counselor educators the opportunity to integrate technology into the training of professional counselors.

In the early 1980s, editors of professional journals for counselor educators began publishing articles dealing with the issues and uses of technology (e.g., Phillips, 1983; Walz & Benjamin, 1983; White, 1984). The use of technology cited in these articles included word processing, instructional enhancement, career and educational information, measurement and evaluation, and research and statistics. Lambert (1988) followed four years later with a reflective look at computer use in counselor training that had been previously reported and included a review of the advances in computer technology for developing training applications in counselor education. More recently, articles have been published focusing on specific applications of technology in counseling and counselor education (e.g., Myrick, 1997; Myrick & Sabella, 1995; Stevens & Lundberg, 1998).

As a recent entrant into the ranks of counselor educators and an avid user of the Internet, I have provided introductory Internet experiences for students enrolled in the courses I teach. To date, I have integrated the Internet into four courses: Career, Vocational, and Educational Information; Guidance of Elementary School Children; Introduction to Systems Counseling; and Principles of Counseling. This article presents ideas for the introduction of Internet experiences as *resources* for counselor educators. Following the conclusion, the addresses are given for the Internet sites included in this article. This sub-heading is appropriately titled *resources*.

An Introductory Internet Search

The first assignment in each course is to search the Internet for counseling resources related to the course topic. For this assignment, I develop a series of questions about the course topic along with three or four suggested Internet sites for the students to visit for information that will answer the questions. The last item on the assignment instructs students to identify a minimum of three sites they have visited beyond those on the assignment. I then compile a composite listing of the Internet sites for the students that includes the Internet address and reference information (e.g., http://www.coounseling.org/ American Counseling Association [ACA] home page).

Sources of Information on the Internet

A course dealing with career development and counseling (i.e., Career, Vocational, and Educational Information) lends itself to using the Internet as a source of information and a resource for counseling. One assignment in this course is to complete research on various job titles. In completing the assignment, students become familiar with a variety of career, vocational, and educational information sources. By using the Internet, students are able to access government documents (e.g., Dictionary of Occupational Titles, Occupational Outlook Handbook), state resources, (e.g., State Occupational Information Coordinating Committee), and Internet domains (e.g., Monster Board, The Riley Guide).

Another assignment, pertaining to a career counseling intake interview, encourages students to use Internet sources to prepare for the interview and to develop resources for client activities between sessions. As part of the take home final examination in the course, students complete one assessment instrument available on the Internet (e.g., The Values Game, Keirsey Temperament Sorter), develop their own card sort based on job titles, and complete two case studies. Both the card sort and the case studies have components that can be addressed using resources available via the Internet.

Electronic Counselor Education Sites

Through the introductory activity in each course, students are made aware of and are encouraged to subscribe to electronic newsletters (e.g., ACAeNews, ASCD bulletin), to participate in counselor network sites (e.g., CESNET, International Counselor Network [ICN]), and to access counseling literature.

ACAeNews is an electronic newsletter of particular interest to counselors as well as counselors-in-training. The subscriptions are free and, once an individual has subscribed, current issues of the newsletter are automatically forwarded to subscribers. Each issue contains an overview of current issues related to counseling, links to related sites, and links to expanded articles highlighted in that issue.

The counselor network sites are listservs that facilitate networking through electronic discussion forums via e-mail. An individual can e-mail a thought, question, or response to the forum, and the listserv software re-transmits the e-mail to the entire mailing list. Recently, electronic sites focusing on the concerns of graduate students in counselor education programs have emerged (e.g., COUNSGRADS) and are of particular appeal to our students.

Journals (e.g., Journal of Adult Development and Aging) and articles (e.g., ERIC Digests) available electronically give students access to information for research papers and course presentations. By using an Internet connection from home, students can access information at any time of day or night even if they do not have library access via the Internet.

Resources for Course Assignments

An objective for each counseling course relates to ethical practices. Reviewing case studies and applying the Ethical Code and Standards of Practice is an excellent way to inform students of counseling ethics and to stimulate discussion about ethical conduct. Although counseling textbooks often include the Code and Standards from one or more of the counseling associations, it may not be the most current edition. However, the Internet sites for the counseling associations do include access to the Code and Standards.

Therefore, the course assignment is for students to access the most current version of the Ethical Code and Standards of Practice (e.g., ACA, National Board for Certified Counselors [NBCC]) and to print a copy for use in reviewing the case studies. By accessing the information via the Internet, students are able to obtain the most current edition of the Code and Standards for a variety of counseling associations. This approach allows case studies dealing with ethical issues to be distributed in class one week with discussion the following week where the focus of discussion is on both the students' ethical decisions and the basis of the decision-making process. Students become aware both of the basis for decisions and of numerable Codes and Standards dealing with ethical practices in the counseling profession.

Professional Organizations

Many of the professional organizations for counselors have Internet sites (e.g., ACA, National Career Development Association [NCDA]). State counseling associations (e.g., Texas Counseling Association [TCA]) also have become accessible through the Internet. Students visit these sites for many of their assignments (e.g., how many divisions are there in ACA?), for access to membership information, and for information about professional growth opportunities (e.g., conferences, seminars). This is an opportunity to encourage the professionalization of counselors-in-training.

More Ideas

Numerable faculty members on our campus have moved into cyberspace by offering courses through distance education. Faculty members are placing syllabi on-line, students are submitting assignments via the Internet, and the university is offering entire courses via the Internet.

My next step is to develop a site for the Counseling Program that will include "hot keys" linking users to various counseling resources. The site will include links to program admission information, to the home page for individual faculty members, and to syllabi for a variety of counseling courses.

Based on my review of the literature related to the use of technology in counselor education that I completed for this article, I have identified a need to inform counselor educators of the current use and of the possible uses of the Internet in counselor education. This article is my first step in sharing the information about integrating the Internet into counselor education. In the near future, my plans are to use the Internet to collect data on the current use of the Internet by counselor educators across the nation.

Conclusion

Although the debate on Internet counseling *practices* continues, there are many opportunities for counselor educators to use the Internet for counseling *resources*. Activities to introduce the Internet, to use the Internet as a source of information, to access electronic sites for networking, to complete assignments, and to become familiar with professional organizations can be a proactive approach to integrating the Internet into counselor education. Further, counselor educators can use the Internet as a resource for counseling information, program information, course syllabi, and professional research.

Resources

ACAeNews
http://www.counseling.org/enews/

American Counseling Association (ACA)
http://www.counseling.org/

Association for Supervision and Curriculum Development (ASCD) bulletin
http://www.ascd.org/pubs/bulletin/ebullet.html

CESNET
LISTSERV@VM.SC.EDU

COUNSGRADS
listproc@lists.acs.ohio-state.edu

Dictionary of Occupational Titles (DOT)
http://204.245.136.2/library.htm#dot

ERIC Digests
http://www.ed.gov/databases/ERIC_Digests/index/

International Counselor Network (ICN)
ICN_request@ctrvax.vanderbilt.edu

Journal of Adult Development and Aging
http://www.uncg.edu/~jemyers/jada

Keirsey Temperament Sorter II
http://www.keirsey.com/

Monster Board
http://www.monster.com/

National Board of Certified Counselors (NBCC)
http://www.nbcc.org/

National Career Development Association (NCDA)
http://www.ncda.org/

Occupational Outlook Handbook
http://stats.bls.gov/ocohome.htm

State Occupational Information Coordinating Committee (SOICC)
http://www.noicc.gov/files/nsoicweb.html

Texas Counseling Association (TCA)
http://www.txca.org/

Riley Guide, The
http://www.dbm.com/jobguide/careers.html

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http://coachlee.com/valugame/LongList.html

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An Inclusive Web: Cyber-training Regular & Special Educators

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This presentation seeks to illustrate an on-line project that supports an undergraduate and graduate Exceptional Learner course (required for all pre-service regular and special education students). The web-enhanced course that we have developed offers a general introduction to the characteristics of exceptional learners and their education. The course, Exceptional Learners (i.e., introduction to special education), is dedicated to providing a general exposure to the characteristics of individuals with special needs, as well as instructional modifications and behavioral management techniques that can employed to assist individuals in the regular education environment. It is the intent of this course that participants will become more comfortable in the identification and educational requirements of students with special needs. Because legislation and subsequent litigation, related to the education of children and youths with disabilities has become increasingly specific and mandatory, this course also reviews relevant special education law and how it applies to the education of students with special needs.

We selected this course because of the direct application to a wide audience of preservice special and regular education teachers. Traditionally, this course has been a requirement for all pre-service teacher educators in our teacher education programs, (e.g., elementary, secondary, and special education) and for many individuals preparing for careers in related education professions (e. g., school psychology, communication disorders). A major goal of this project was to create a resource that would be applicable to teacher education needs beyond the confines of Bowling Green State University and University of Toledo.

The on-line project that we have developed as an introduction to special education involves three web-based components. The first, titled Course Basics, includes a section dedicated to course basics found in a typical teacher preparation course (i.e., course syllabus, readings). The second, Assignments, incorporates web applications enhancing traditional instruction, offers access to relevant special education materials, and incorporates a number of on-line library resources and related Internet applications. The final section features Web-based Case Studies which seek to combine theory with practice in an interactive manner.

The Virtual Resource Center in Behavioral Disorders: Dissemination and Evaluation of Instructional Supports via the World Wide Web

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Abstract: This paper presents a World Wide Web site designed to provide training and ongoing support for students and professionals preparing to work with children with behavioral disorders, and their instructors. Design features and content of the site are presented along with a discussion of the ongoing collection of quantitative and qualitative data related to site usage and learning outcomes.

Theoretical Base

Materials designed to assist teachers in working with students with behavioral problems are currently in high demand. According to *The National Educational Goals Report* (NEGR, 1995), such training includes 93% of America's teachers. There continues to be a high demand for training programs in behavioral disorders from local school districts and state departments. Unfortunately, as Gersten, Morvant, and Brendelman (1995) document, there is a gap between educators receiving training and altering what happens in the classroom. The mission statement of the U.S. Department of Education's Professional Development Team, an outgrowth of the Goals 2000 legislation, emphasized the need for on-going, long-term, continuous programs designed to promote collaboration, collegiality, and inquiry by all members of the school community (1996).

The design and development of World Wide Web sites as a delivery medium for instructional supports in both pre-service and in-service teacher education have been well documented. Research and evaluation of these web-based supports, however, is in its infancy with much of the information being purely descriptive in nature (Newmarch, 1997, Windschitl, 1998). Web-based delivery of instructional supports for teachers can, it appears, overcome many of the drawbacks inherent in traditional delivery methods (Shotsberger, 1997). Although these technologies appear promising, there is a need for research focused on instructional outcomes and what teachers actually do differently or better because of their readily-available access to information and support.

Virtual Resource Center in Behavioral Disorders Web Site

The Virtual Resource Center in Behavioral Disorders (VRCBD) was constructed to provide training and ongoing support for pre-service teachers and field professionals who utilize the *Teacher Problem Solving Skills (TPSS)* programs and their instructors. In addition, opportunities for electronic communication provided through the VRCBD web site enable social discourse among teachers around the instructional materials and current topics in behavioral disorders.

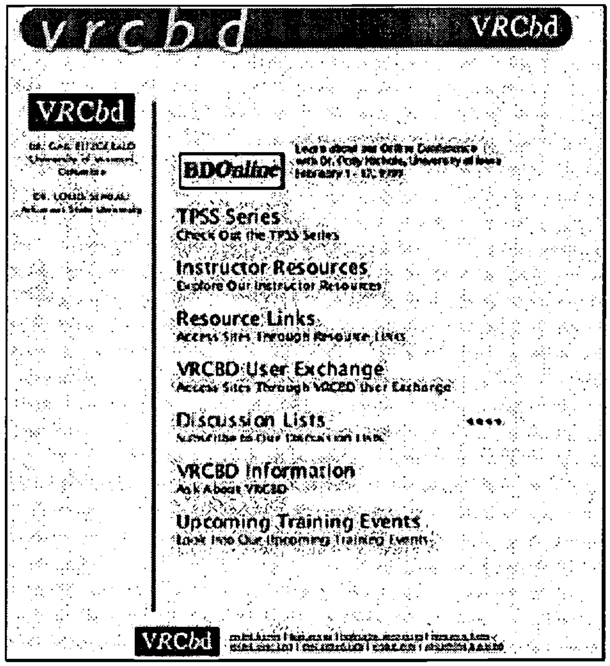

Fig. 1: VRCBD Main Menu

A Tour of the Virtual Resource Center in Behavioral Disorders

The goals of *VRCBD* are:

- to provide instructional supports for instructors and users of the *TPSS* programs; and
- to provide an opportunity for asynchronous and synchronous communications between pre-service and in-service teachers and professionals in the field of behavioral disorders.

The Main Menu (Fig.1) of the VRCBD site was designed to give users easy access to all aspects of the Virtual Resource Center. From this screen the user can access descriptions and dissemination information about the *TPSS* Series. These multimedia programs use case-study scenarios and classroom videos to provide problem-solving experience in the processes of investigation, assessment, planning, and observation needed by professionals serving children with social, emotional, and behavioral disorders.

The Instructor Resource area of the VRCBD gives instructors using the *TPSS* Series access to teaching materials and other resources available for use in their training programs. Printable materials are available in PDF (Portable Document Format) files and include conference papers related to *TPSS*, transcripts of expert commentaries from the programs, and forms for use with the *TPSS* programs. Access to an electronic discussion forum provides an opportunity for asynchronous communications between instructors across the country and VRCBD personnel. Planning for the BDOnline Workshops and other training opportunities is facilitated through this discussion list. In addition to these *TPSS* related resources, links to a wide variety of Internet resources related to behavioral disorders are available through the Resource Links section of the VRCBD. Contributions of additional resources are welcomed and are easily communicated to the VRCBD staff through a hyperlink.

The authors of the *TPSS* series and members of the VRCBD staff provide frequent training opportunities at national conferences and at a week long Summer Institute held on the University of Missouri

campus. Information on upcoming training events and registration for the institute are available through the VRCBD site. Other areas of the VRCBD contain information on the authors and contributors of the *TPSS* series.

Establishment of an online community where professionals and students in the field of emotional and behavioral disorders can interact in regular discussions and idea sharing is one of the primary goals of the VRCBD. Three online conferences (BDOnline) are scheduled for 1999. Experts in the field of behavioral disorders will establish an "online presence" through the VRCBD conference. Instructors and in-service leaders will be invited to bring their classes online during a two-week period for interaction with the expert. Readings will be furnished as PDF files for download to establish a common ground for discussion.

In addition to the virtual conferences the VRCBD can establish connections between classes using a particular *TPSS* program. Discussion lists have been established for each of the four programs and the VRCBD maintains a current database of instructors using the programs to facilitate these connections. Synchronous discussions between classes or in-service groups wishing to interact in real time is also possible in the VRCBD chat room. This room uses *EveryChat* software installed on the University of Missouri's College of Education web server. This software facilitates online chats without the need for additional software installed on remote users' computers. Users simply log into the *EveryChat* environment using their web browser.

In addition to these opportunities for online communication, the VRCBD has provided a User Exchange area to facilitate the sharing of instructional ideas and technical assistance for professionals wishing to share their ideas through the web, thus enabling transfer of training. Members of the VRCBD staff are available to create web pages or assist those wishing to create their own pages for the publication of instructional ideas on the web. Space has also been designated for instructors to share their course web pages, demonstrating how the *TPSS* programs are used in their course curriculum. In addition, web publishing as a means of sharing ideas is taught as part of the VRCBD Summer Institutes.

Methods for Data Collection

Reeves (1998), in proposing the best means for answering critics of media and technology, emphasized that efforts to integrate media and technology into education should be guided by strong research and evaluation. In order to evaluate the effectiveness of the instructional supports provided through the VRCBD, quantitative and qualitative data are gathered continuously from the site.

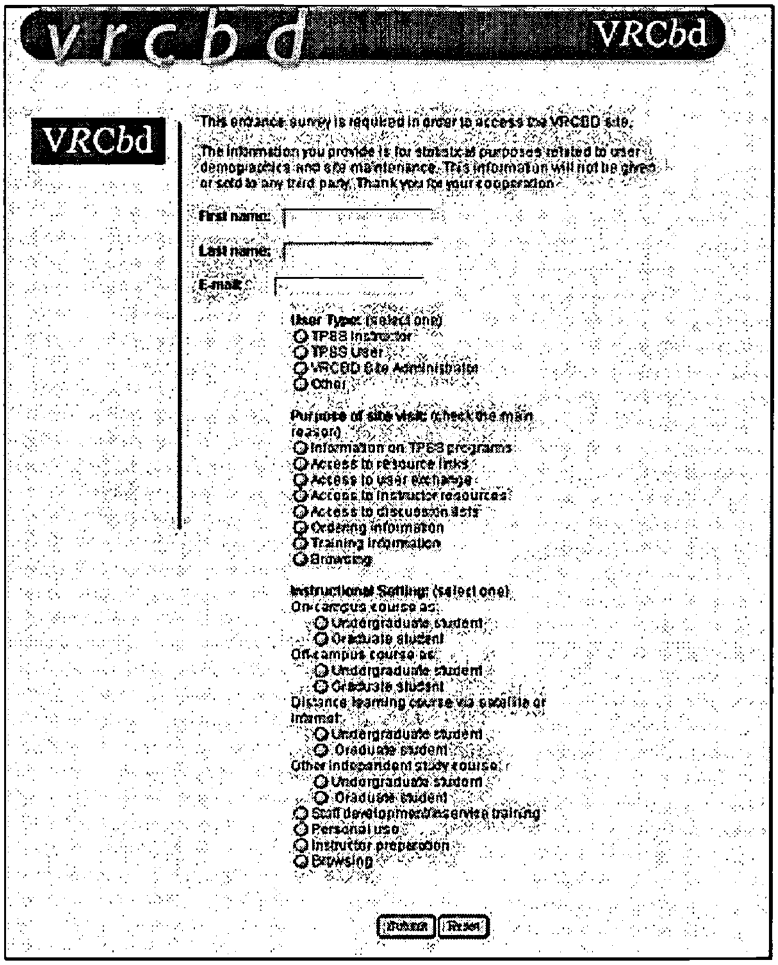

Figure 2: VRCBD Entrance Survey

In order to determine who is using the site, a user survey was designed as a requirement for entrance into the VRCBD pages (Fig. 2). The survey consists of a simple form where the user supplies his name and e-mail address, and answers three questions describing reasons for visiting the site. This information is collected using a custom CGI (Common Gateway Interface) script. Data are available as either an HTML page displaying each user in order, or as a text delimited file that can be imported for use in statistics or database programs. Completion of this survey places a temporary "web cookie" in the user's browser. Subsequent pages use an additional CGI script to check for the presence of this "cookie." Attempting to enter the site without filling in the survey information gives the user an error message and returns them to the survey page.

In addition to the survey page, a custom tracker is also installed on the VRCBD site. This tracker logs site usage data including Internet addresses of visitors to the site, pages visited, and time spent at VRCBD. This information can be displayed in graphical form or is available in a text file.

In order to evaluate the growth and effectiveness of communications, data can be gathered from synchronous and asynchronous discussions at the Virtual Resource Center for qualitative analysis. All messages to the VRCBD discussion lists are automatically archived on the College of Education server. This information is searchable and can be sorted by subject, date, or author. The *EveryChat* software used for real time discussions creates a transcript of discussions that can be used for analysis of emerging themes and can also be sent to discussion participants via email. Additional data will be collected from participants of the online conferences. Survey instruments have been placed as PDF files on the BDOnline page. Instructors choosing to include the online conference as a class assignment are requested to collect data from their students. Survey instruments include:

- Daly-Miller Writing Apprehension Test;

- Kolb Learning Styles Inventory;
- Prior Computer and Telecommunications Use Survey;
- Education and Experience Survey; and
- Participant Follow-up Survey

Through these instruments the researchers at the VRCBD hope to gain information regarding web site usage as related to user differences in such factors as writing apprehension, learning styles, prior experience, education, and satisfaction.

In the future the VRCBD hopes that the web site will become an online forum for the sharing of instructional ideas through web pages contributed to or by professionals who are actively using the strategies and techniques presented through the *TPSS* programs in their work with children. The fourth *TPSS* program, soon to be released, presents performance support tools for developing a variety of cognitive-behavioral interventions. As teachers and professionals use these tools, their strategies will be collected in the User Exchange area of the VRCBD. These contributions will be analyzed as one more means of determining the effectiveness of these web-based instructional supports.

Expected Results

Through the quantitative and qualitative measures described above, researchers at the VRCBD will study the implementation of telecommunication supports for the purpose of understanding their impact on the development of knowledge, skills, and reflective processes by pre-service and in-service teachers and professionals. The evaluation procedures now in place for the VRCBD will enable project staff to study in depth the impact of each web-based instructional support on learner outcomes. Over time multiple data sources will be used to examine relationships and generate hypotheses for further study. Variables which impact the effectiveness and efficiency of web-based instructional supports for personnel preparation in behavioral disorders will be identified and recommendations will be made for the effective use of telecommunications in these programs.

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Identifying the Technological Needs of the Special Needs Teacher

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Abstract: Who is choosing the computer software for learners with exceptionalities and special needs at your school? Is the selection and purchase of software delegated to the technology specialist or a committee of classroom teachers? Has the special education teacher been consulted during the decision making process? In any of these scenarios, how many of these educators have been trained to select developmentally appropriate software for children with special needs? This study was designed to address these concerns by surveying faculty and resource specialists from 78 elementary schools in a south Florida county in order to: (a) identify the criteria primary grade special education teachers use when evaluating computer software; and (b) identify special education teachers' needs to assist them in the selection of software for purchase.

Introduction

All teacher education programs are based on a variety of standards and criteria set forth by numerous regulatory bodies. Special Education is no exception as is guided by the Council for Exceptional Children International Standards for Teacher Preparation (1998). Today's special education teachers are expected to make instructional decisions concerning the vast opportunities technology has to offer the student with special needs. Many of those teachers are without technological foundational knowledge and competencies that are essential to improve and enhance the learning processes in the classroom. Unfortunately, many special education faculties have not been inserviced adequately to provide fundamental skills necessary to utilize technologies appropriately.

In most educational settings, technology specialists make hardware decisions and the unaware and untrained instructor makes software decisions. Thousands of dollars are spent by school districts across this nation every year to purchase software which is thought to be developmentally appropriate for young children with regular and special needs. Special education faculty without proper knowledge and training of both hardware and software may be making instructional decisions that are inappropriate or detrimental to the learning process in regards to the uses of technologies.

Although teachers have been using computers with their students in primary grade classrooms for well over a decade, the quality and availability of computer software has dramatically improved (Coley, Cradler, & Engel, 1997). Today, teachers can select from hundreds of software titles to use with their students. However, some

software is not developmentally appropriate for young children, especially young children with disabilities. With the abundance of titles available, selecting a developmentally appropriate program becomes a challenging task. Shade (1996) asserts it is critical for teachers to select developmentally appropriate computer software for use with young children. When teachers use developmentally appropriate computer software, they are providing opportunities for children to control their environment, stimulate their imagination, and use open-ended exploring to facilitate higher order thinking (Haughland, 1992). These opportunities are immensely important for students in special education in order to provide access to a range of interactive and cognitively stimulating experiences using the computer.

Despite the research supported benefits of using developmentally appropriate software to improve children's use of language, turn taking, and ability to make decisions (Borgh & Dickson, 1986; Escobedo & Evans, 1997), many teachers do not use a research based criteria for evaluating software and choosing hardware. Haughland and Shade (1992) developed a software evaluation scale that provides guidelines based on the National Association for Young Children developmentally appropriate criteria. They suggest teachers consider the developmental appropriateness of software in the following areas: (a) age appropriate, (b) child control, (c) clear instructions, (d) expanding complexity, (e) independence, (f) process orientation, (g) real-world model, and (h) technical features. By using these criteria as a guide during software selection, teachers can make informed decisions rather than using a random selection process. Bender (1995) describes the process which many teachers use when purchasing software for their classroom, "Teachers are typically given a software catalog with the titles of the software, a brief description, and price" (p.33). If teachers are using this type of illogical method for selecting software, it is probable that their software choices lack the developmentally appropriate characteristics that can provide the most benefits for students with disabilities.

Despite the plethora of software titles and knowledge of software evaluation, teachers of students with disabilities may have difficulty locating high quality developmentally appropriate software to meet the specific needs of their students. In that case, teachers can provide insight into the types of developmentally appropriate software needed in early childhood classrooms.

Research Questions

The research questions of the study were:

1. What criteria do primary grade special education teachers use when evaluating computer software?
2. What specific instructional areas do teachers identify for software development for young children with special needs?

Purpose

The purposes of our study are to investigate how special education teachers in primary grades classrooms, pre-kindergarten through second, evaluate and select computer software for use with their students as well as identifying teachers' needs in software development to meet their students' instructional goals.

Methodology

Participants

The sample included 234 faculty and resource specialists from 78 elementary schools in one Florida county. Faculty surveyed included: (a) specialists teaching in resource classrooms; (b) teachers instructing in self-contained classrooms; (c) teachers providing instruction in classrooms implementing inclusion, and (d) teachers serving students with varying exceptionalities.

Instrumentation

The questionnaire was designed by the researchers to: (a) identify the criteria primary grade special education teachers use when evaluating computer software; and (b) identify special education teachers' needs to assist them in

the selection of software for purchase. The last section includes a number of demographic questions including: (a) gender; (b) years in the teaching profession; and (c) years employed at their present school. A pilot study is being conducted at 3 elementary schools. The purposes of the pilot study are to: (a) test the questionnaire items in the instrument for item validity and reliability; (b) enable the researchers to observe respondent and instrument responsiveness; and (c) to obtain direct comments from respondents about clarity of questionnaire items, instrument length, and clarity of the directions.

Data Collection

Data are to be collected both quantitatively and qualitatively using the software questionnaire and unstructured interviews with special education faculty. Participants will have a choice of how to complete the questionniare: (a) paper, and (b) via the Internet. A cover letter, which is part of the actual survey, and an envelope for return mailing, will accompany each paper survey. A reminder notice will be sent two weeks after the initial mailing. This reminder notice will not include a survey. A final mailing, which will include a survey, will be conducted two weeks after the reminder notice.

Data Analysis

The quantitative data from the Survey items will be analyzed using SPSS for Windows v. 8.0. A Microsoft Access for Windows 95 database was designed to improve the reliability and ease of entering and organizing the data from the completed surveys. The .05 level will be used to determine statistical significance.

The qualitative data from the unstructured interviews will be analyzed using content analysis. The researchers hope to identify themes in the data that point to something important for the participants being studied. For instance, in one study, failure to use software the "right" way became symbolic for failure to conform to organizational norms. Concepts will be developed from the data that will help to explain particular phenomenon such as a teacher's willingness to use one software program for more than one task. Triangulation will be employed to help the researchers understand the teachers' interaction with software and consequently their students.

Results

For the purposes of this presentation, the results from the pilot study and preliminary data analysis will be included. The instrumentation and research methodology will also be presented.

Implications

This study may provide a better understanding of how special education teachers in primary grade classrooms, pre-kindergarten through second, evaluate and select computer software for use with their students. If the study indicates that special education teachers make software selection decisions without being trained adequately to do so, then inservice training ought to be targeted to enhance each teacher's technological foundational knowledge and competencies. The study may also provide a means of identifying teachers' needs in software development to meet instructional goals. The results of this study can provide a means to match existing software with individual teacher needs. The study could also provide the researchers with crucial information for constructing developmentally appropriate software. Several of the researchers are involved with courseware design projects that may be tailored to meet instructional needs for enhancing and improving the learning processes in their classrooms.

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E-mail between Children With and Without Hearing Disabilities: The Case for Teacher Intervention

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Abstract: This study examined the consequences of establishing e-mail communication between two classes in different schools: a fifth grade of children with hearing difficulties and a fourth grade of children without hearing difficulties. The arrangement provided an opportunity for children to interact with peers whom they would not normally meet at school. Relying on material from their own social studies curriculum, pairs of children exchanged information in a structured fashion. This allowed children to assume the role of both teacher/resource and learner and to develop potential friendships in an ongoing correspondence. Results indicated that successful implementation requires significant teacher intervention by integrating the program with the existing curriculum. One unexpected but important effect of this bridge between schools was the exposure of participating teachers to school cultures distinct from their own, particularly in regard to differences in teaching methods. This can lead to a reassessment of values and curriculum needs.

Introduction

This paper describes a structured, collaborative-e-mail-based model for communication between remote classrooms that was used in a project in which e-mail was used to bring together two populations of children that would not ordinarily have the opportunity of interacting together. One population was a general education class within a public school and the other population was a class within a school for children with hearing impairments. The purpose of the project was to increase social and academic development for both groups. The paper focuses on the role that teachers must assume and the necessary place of the model in the curriculum if this kind of electronic collaboration effort is to succeed.

The paper also examines the potential benefit of this model for teachers who are isolated by their unique functions. For example, special education teachers using this model can gain access to perspectives and teaching methods that may have been overlooked because of their own focus on compensating for their students' disabilities. Regular education teachers can also benefit from this interactive approach by becoming more acquainted with children whose abilities and experiences differ from what they have come to expect.

Background

Children with disabilities whose problems cannot be met in general education classes are frequently placed apart— sometimes in entirely separate schools with populations of children who share similar problems. As a result, children in general education often have little contact with these children. Attitudes that develop rely on stereotyped images that often perpetuate distorted information (Roberts & Reaves, 1983).

At the same time, an insulation results for teachers in special schools as they develop their own culture, which reinforces its own values and approaches, and primarily supports their expertise in the area of the child's disability. Lost is the interaction with colleagues in general education and access to diverse methodologies. This reinforces the focus on the disability at the expense of general needs that exist in all children.

To overcome this isolation, we developed a structured model for e-mail communication that fosters both academic and social opportunities in the context of cooperative learning. Specifically, the communication in our project is the exchange of knowledge that children acquire from their social studies curriculum. Thus children take on the roles of both teacher and learner. When the child plays the role of teacher, learning takes on greater meaning as ideas are actively reviewed and reorganized in order to explain them in writing. Thus, each child's own knowledge is deepened through rethinking and recording ideas, and by replying to further questions that the information they send elicits. Playing the role of learner— using the other child as resource/teacher—breaks down traditional stereotypes. Each child is valued for his or her complementary knowledge.

Methodology

Population

Two groups of children in different schools in Brooklyn were selected. Both groups were gender-balanced, ethnically diverse but similar socioeconomically and intellectually.

One group consisted of English-speaking fourth grade children with no disabling conditions. They attended a mixed-grade general education class in a public school where creative problem-solving through student interaction, and constructive discussions between peers was emphasized. The children in this class were also heterogeneously grouped with regard to intellectual abilities

The second group consisted of fifth grade children in a school for the deaf. Their common defining characteristic was some degree of hearing dysfunction ranging from severe to profound loss. Their most outstanding difference with the first group was the use of American and English Sign Language as their primary means of communication. The children wrote in English, but exhibited a slower rate of progress in writing skills because of the disadvantage caused by hearing loss.

Project Procedure

Teachers in the participating schools paired children from the two groups by gender, behavior style, shared or complementary interests and as closely as possible for writing level in order to promote the social and educational goals of the experiment. The purpose of the pairing criteria was to encourage the children to become acquainted with each other over the course of the school year through a structured cooperative framework where social studies information, issues and ideas were exchanged, ultimately providing the potential for friendships to form.

The most essential procedural element for the success of this project was for the teachers to integrate the e-mail exchanges into their existing social studies curriculum. The following guidelines were given:

1) Review and chart the most interesting aspects of the social studies topic.
2) Display and provide charts, books and other materials as resources for students.
3) Have students work together to generate issues, information and opinions.
4) The message exchange should be simple and concrete.
5) Focus on the content of the message and not on a grammatically correct message.
6) Generate a list of questions about what they'd like to learn from the collaborating class.

There were two phases to the communication process.

Phase 1. The first phase helped children gain familiarity with e-mail technicalities and its informal protocols and begin the contact with their partners. During this phase, children informally shared personal information with one another. A typical message from a child with hearing limitations would include their name, age, a statement about their disability, the number of people in their family and their current interest:

Dear ___,
Hi, How are you ? I am fine. My name is ________. I am 11 year old. I am deaf. How are year old? I born in Barbados. My birthday when aril, 6 1985. Where you born. When your brithday? What your favorite to play game? My favorite play game baseball.
Write back soon!

Mail from children without the disability tended to be less formal:

Dear _____
Hey how ya doi'n. Are you a girl or boy beacause i'm a boy. How old are you i'm 9 . Do you have a class project I do.What is your reaserch thing.Do you like Fish. Is your teacher nice WELL
I GOT TO GO NOW SEE YA

Phase 2. Next, a more structured interchange was established and continued until the end of the school year. Each message was to contain at least one piece of information that the child had found interesting in their social studies curriculum and one question that he or she had concerning the topic that the e-mail partner was studying. Teachers could introduce the social studies exchange by using some variation of the following model:

> Children in class X have been studying _____ for a few weeks now. Instead of me teaching this to you, I'd like you to find out as much as you can about this topic from your e-mail partner. Let's write up a chart of questions we want to ask. Then each of you can print out what you've learned. We can put this information together into a book or we can make a chart that displays the questions and answers.

Below are some representative notes from the children during this phase:

Dear _____
How are you? I'm fine
I have Dante's Peak at home. I realllllyyyyyyyy like that Movie. I learn about Canada. They love hockey and vvvveeeerrrryyyy CCCCOOOOLLLLDDDD weather

Dear _____,
We saw a video tqoday and it was about the arctic. Teacher keeps on showing us arctic videos.
We saw polar bears, walruses, penguins, huskkkys, and seals. In the summer in the arctic there is a tiny bit of snow and there are different kinds of wild flowers.
What are you studying now?

Dear ____,
Canada love ice hockey and ski. Canada is cold because Canada is north.
see shoe and boot for cold weather outside wet socks need hang to dry.
Can go skiing.
Now we study Mexico.

The second phase especially required the teacher to incorporate this project into the existing social studies curriculum, to treat e-mail as an integral part of the school day and to enable all children to participate in it on a regular basis. No new curriculum material was necessary for the teachers to develop, just to review and to create questions for the other class.

Evaluation Criteria. The project was evaluated qualitatively, by examining e-mail content, and quantitatively, by considering e-mail frequency. We also looked for asymmetries in e-mail usage between the classes.

Results

As the project evolved, we began to notice that the teachers in the two participating classrooms had very different approaches to the use of e-mail, and it is this difference and its impact that constitutes the core result of this paper.

Outcome: School 1 (the general education class)

The childrens' initial response to this project was one of sheer excitement. After the system was installed and we exchanged mail with each child, we visited the class. It was indicative of their enthusiasm for the new medium that children spontaneously stood up and excitedly introduced themselves. A typical comment was:

"Hi, I'm A___. I'm the one who wrote to you about X".

Early messages between children reflected the same initial excitement. For example:

hi it is me ___________ I am so glad you wrote to me . my favorte tv show is the same one is yours . i will like to see you one day in person . i hope you will like to see me to .

Dear ____,
Isn't the Net cool?! I meen, I can't see you but I can read what your thinking from miles away (or just 10 minuts away). Okay we have alot of catching up to do. My favorite color is blue..."

I am glad you are my p.p. I would like you to send longer letters to me. my phone number is _____________. can you give me yours. I wont to send you alot of leters so you will get alot of mail. will you give me alot of mail. How do you pernonce your name.

As we will see below, limited access to the computer in School 2 led to infrequent responses to School 1. This caused the School 1 children to write messages such as, "`write to me, write anything!`" By June, with continued limited response from their partners, enthusiasm had changed to dissatisfaction and reluctance to participate. One youngster, speaking to his teacher said, "do I have to?". Many messages illustrated frustration with not receiving mail.

Dear _______,
Why havn't you talked to me? I would like to talk to you! Talk to me!
TALK TO ME 111
mesplease!
I want to tell you my poiems! I want to just say stuff! Please just at least once, Well, before I go crazy (which I am already) I'll go.
Bye!

Dear ___
Where are you I"ve wrtoe and wrtoe to you but you don't write to me Is your computer broken? Is your shool closeed? Any way wane dose your school close? I have no idea what to say so good--by
from ,
___

Outcome: School 2

Each child had one designated time each week for checking, responding to and sending new mail. However, these times were often pre-empted by other work. Children could only use e-mail when the teachers told them to and so the task became an assignment that lost the joy and natural curiosity it was expected to promote. These external constraints interfered with timely response to, free communication with, and a development of interest in the children with whom they were paired. The result was frustrating at best.

School 1:
HI! HOW ARE YOU/I AM FINE. WHAY ARE YOU NOT SENDING ME ANYTHING? BYE NOW

School 2:
Dear ____
HI, HOW ARE YOU? I AM FINE! WHAT HAPPEN YOU NOT E-MAIL ME? I WAIT FOR YOU E-MAIL ME! PLEASE HURRY YOU E-MAIL! OK! NOW WHAT LEARN ABOUT CANADA? I LEARN ABOUT MEXICO REAL COUNTINE! I GOT GO CLASSROOM! GOOD BYE!

E-mail Tabulation

Tabulation of e-mail traffic revealed a sharp disparity in the number of e-mail messages sent between the two classes, consistent with the imbalance of class time that was set aside for e-mail use. Greater than twice the amount of messages were sent from the School 1 children than were received by them (179 vs. 81). From teacher reports and our own observations, we also noticed a disparity in the amount of time it took to write messages.

Discussion

Additional roles of the teacher

After a year's experience in this project, we can identify three additional underlying elements of the teacher's role:

Technical functions. The most commonly examined role is the technical one. The teacher is responsible for introducing basic machine and network access procedure, e-mail operations, editing and e-mail message conventions— particularly the one that overlooks typographical and spelling mistakes. Content is primary; form is not. When teachers belabor form, communication becomes a chore for the students and teachers alike and the effort reduces spontaneity, and makes the goals of this project less obtainable.

Integration into the curriculum. Computer access is a major source of contention both between children and for each child's time allocation during the school day. In order for an e-mail project to benefit and not detract from other activities, it must be integrated into the ongoing activities and become part of daily ongoing assignments.

Psychological functions. Because e-mail is inherently interesting and self-motivating, initially little additional teacher intervention is needed. However, when technical problems interfere with message transfer or when e-mail partners fail to respond, children understandably become frustrated. At this point teachers must encourage children to overcome hurdles and to help them resolve problems. This role is especially important because the sense of frustration can generalize onto the e-mail partner and negatively affect attitudes toward that person. This consequence undermines the social intent of the project. Likewise, limiting computer access also affects the quantity, timeliness and quality of the messages and ultimately of peer relationships. The lack of timely responses caused the most frustration. Others have observed this same issue (Allen & Thompson, 1994).

Serving as model . Teacher's messages can serve as a model for children to follow. More importantly, an occasional message from a teacher is always special for a child— and can smooth over rough spots such as technical problems or delayed partner response. The following are e-mail examples of teacher encouragement:

Dear ____,
Here is an old leter from ___ that didn't get through to you
because something was wrong with the computer. Thank you for writing avout Canada!

______,
____'s teacher

Hi ____,
I'm sorry that you have not received mail from ______ lately. She is not in my class so it is sometimes hard to remind myself to give her time on the computer. I will give her your message and I'm sure that she will write soon. I hope you all had a good time at the zoo. I love to go there. There are some really beautiful animals there to see. Take care, and I will talk with you again soon.
Teacher

Dear _____,
_____would really like to hear what you learned about Canada. We are about to study the Arctic, part of which is in canada. What do you know about the weather there?
Teacher
Dear ____,

It seems that ______ was not addressing her e-mail to you correctly, so that her last 5 letters didn't get through to you. I just fixed her addresses so you should be getting lots of e-mail today! Sorry for the problem.

Teacher

Conclusion/Implications

The quantitative difference in messages sent from the two classes demonstrates a systematic teacher impact, either promoting or interfering with the development of this mode of communication.

The success of projects such as this one rests heavily upon the willingness of teachers to integrate e-mail into the children's daily classroom activities and to recognize its value as a natural vehicle for deeper understanding of curriculum through review, reorganization and written expression of ideas, for social learning and for increased self-esteem. In addition, project success depends on teachers' recognition that e-mail can function as a medium for exchanging ideas with colleagues in settings different from their own, and for gaining insights into other teaching methods through the entry e-mail opens. Teachers become exposed to differences in room arrangement and organization, scheduling, teaching methods and children's classwork.

To summarize the required teacher intervention::

a) The teachers of the paired classrooms must agree to meet regularly
b) They must agree to provide daily access to the computer.
c) Teachers must help children receive and send mail until children are self-sufficient.
d) Teachers must encourage their students to develop questions to ask of their e-mail partners.
e) Teachers must ensure that their children will be in a position to provide information about their social studies work to their e-mail partner. For example, teachers may choose to review and chart key concepts, ideas and issues that their children experienced in their social studies units and that could be included in e-mail exchanges.

This program replaces didactic approaches with an open-ended strategy that couples classroom teacher collaboration with paired student cooperation, and integrates a student-driven review of the social studies curriculum with written communication and organization of ideas. It reinforces concepts by using a new avenue for their expression. It extends naturally over the course of the school year, unlike other e-mail projects (Baugh & Baugh, 1997) which are short-lived. Furthermore, this project is completely tied into each student's class curriculum and thus can be expanded into any curriculum area, especially those involving language arts, based on the interests of e-mail partners and collaborating teachers.

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TECHNOLOGY DIFFUSION

INNOVATION.ALT -- Implications for Education of Burke's "Web" Theory of Innovations, Compared to Rogers'

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Abstract: Educators, challenged to prepare today's students for tomorrow's world, know many things will change before today's students get there. Two well-known theorists about the causes, rates, and diffusion of changes into society are James Burke, author of *Connections* (both the television program and best-selling book) and Everett Rogers, author of *Diffusion of Innovations*. Both authors' theories have implications for educators. Burke's "web" theory of innovation is that ideas and people are linked in a "web" of knowledge and events, and that an innovation occurs when someone makes a "connection" between concepts not previously juxtaposed in that specific context, combination, or application. Since Burke assumes that almost any knowledgeable person can be a future innovator, the role of educators is seen primarily as providing students with a solid, conceptual knowledge base as well as preparing them for independent, innovative thinking.

Introduction

On the Nature of Change

All issues about change -- "What is change?"; "Who or what causes change to happen?"; and "Why does change occur?" -- are very *old* issues. Some say that the predisposition to ask these kinds of questions are at the very core of what makes us human.

Sometimes, in the course of human history, civilizations have arisen in which particularly intelligent or insightful individuals have used their observations of the natural world, as well as their own capacity to think, to deduce fundamental, but hitherto unknown, principles of mathematics, science, and medicine, as well as other essential areas of human knowledge. Sometimes, after a period of discovery and growth, an entire culture's progress may be buried in a mudslide of fear, disease, or violent destruction. One such period was the era, roughly 500 to 1000 AD, in Europe, in which the storehouse of accumulated human knowledge was so completely looted during and after the decay and dissolution of the Roman Empire that much of what had been achieved in human understanding until that time -- such as our acquired knowledge about our bodies, our planet, our solar system -- seemed to have been irretrievably lost. This period was so devoid of glimmerings of innovative thought that past historians dubbed it the " Dark Ages."

Subsequently, things got a little better -- but not much. In the Fifteenth Century, for example, just as the Black Death struck Europe and killed an estimated one-third of the total population of France, Spain, England, and Italy, terrified and superstitious survivors of the plague were convinced that such a catastrophe had to have been caused by malevolent agency. With piles of corpses and heaps of bones in common, trench graves stretching out from almost every city in Europe, people who were determined to affix blame for the changes to their world that they didn't understand went on witch hunts, specifically targeting women -- who had little political power and were thus, relatively speaking, safe targets. The Inquisition and the tribunals for the examination of witches operated during the same historical period, sometimes as separate entities, but urgent for many of the same reasons: Changes can be frightening. When the changes come too quickly and when people don't understand what is happening or why, they sometimes become seek to find those on whom they can vent their frustration and fear.

At least during some periods of history, a variety of societies have rejected change outright as too threatening. By some, change was seen as an outright challenge to the gods, or God, and asking questions

or presuming to understand or exert control over specific forces of nature was sometimes harshly punished -- not by the gods, but by humans who had appointed themselves guardians of the gods' presumed best interests. Asking questions deemed irreverent to the gods of ancient Greece earned Socrates his cup of hemlock, and Galileo was forced by the Fifteenth-Century Inquisition to recant -- or else be burned as a heretic -- his assertion that the earth orbited the sun instead of the reverse, which was the accepted "knowledge" of the time.

Inquisitive Minds of the Modern Era

Yet, just when ignorance and superstition seemed destined to clamp an iron mask on the face of human inquiry, during the Sixteenth Century in Europe there was a sudden burst of discovery and creativity, a rediscovery of knowledge long lost, an increase of enthusiastic interest in exploration and connection of scientific and mathematical understanding that no one -- looking at the dismal century that preceded it -- could have anticipated. It suddenly became possible -- during this rebirth or Renaissance of the progress of human knowledge -- to discuss scientific ideas, or to study anatomy and preparation of medicines -- without fear of being accused of heresy and risking execution.

The Renaissance was the gateway to our modern era. Once burst, the dam on the reservoir of human learning and knowledge has never again been reconstructed in a way that has held for long. For better or worse, we have proceeded forward in acquisition and application of information -- as well as ever-accelerating rates of change.

Burke's *Connections* and His "Web" Theory of Change

Burke's *Connections*

James Burke's popular television series, *Connections,* first broadcast on PBS in 1979, focused primarily on the process that led to significant changes that have created the modern world we now know. In each *Connections* episode, Burke focused on exploring the presumably unrelated and seemingly unlikely series of events that lead, step by step, from one historical starting point, through development of this original concept or other related ideas, to the eventual "connection" of one or more of these ideas into a specific, modern technological application -- such as the atomic bomb, telecommunications, computers, production lines, jet aircraft, plastics, rocketry, and television.

Burke's approach was, to his viewing audience, a pure delight. For one thing, he seemed always to be having great and infectious fun with what he called his "historical detective stories." For another, there was something subtly subversive about the way he described the process of development of ideas. Burke's approach was different than the typical historical trivia of assorted names, dates, and places most people memorized in school. Instead, Burke suggested that the process of change was just as big a surprise to the people who lived it as it is to us when major changes happen in our time. Change, in other words, just happens.

Burke, in the revised introduction to the recent reissue of his *Connections* book, says, "...there's no grand design to the way history goes. The process does not fall neatly into categories such as those we are taught in school.... Things almost never turn out as expected....Change almost always comes as a surprise because things don't happen in straight lines. Connections are made by accident. Second-guessing the result of an occurrence is difficult, because when people or things or ideas come together in new ways, the rules of arithmetic are changed so that one plus one suddenly makes three." (Burke, 1995)

Burke's general narrative structure is on the branching path of possibilities and connections that lead up to specific discoveries. In a way, Burke entertains by telling historical "shaggy-dog" stories, with the punchline being his revelation, in the final few minutes of the program or the final page of the chapter, of the particular development that all the loose threads he has been following tie into. The story itself is usually interesting to follow, because many of the landmarks he points out -- as he leads the viewer or reader, Pied-Piper-like, through the last five hundred years or so of history -- are familiar ones, but Burke makes them seem fresh, because he portrays them in a dynamic context. The Introduction to this paper was intended to provide an abbreviated, Burkean kind of context for the topic of change, in general, and points out, on the way, familiar historical touchstones -- fall of the Roman Empire, "Dark Ages," the Black Death, the Inquisition, the Renaissance -- that end up being combined in slightly new and different conjunctions than is common.

Past Changes -- Why They're Important to Understand

In the introductory and concluding chapters of his *Connections* series, Burke expresses his overall belief about how and why the historical development of ideas should be studied. He says, "... an understanding of how change happened yesterday may provide clues as to how it might happen in the future. (p.*vii)*" Burke adds , "The process of innovation is shown to be influenced by several factors recurring at different times and places; although these may not be repeated exactly each time, the observer becomes aware that they may recur in his own future, and is therefore more able to recognize them should they do so. The structural device used [in *Connections*] is to examine an event in the past which bears similarity to one in the present in order to see where such an event led. ... The purpose of this approach is to attempt to question the adequacy of the standard modern schoolbook treatment, in which ... historical change is shown to have been generated by the genius of individuals, conveniently labeled 'inventors.' In such a treatment, Edison invented the electric light, Bell the telephone, Gutenberg the printing press, ... and so on. But no individual is responsible for producing an invention *ex nihilo.* The elevation of the single inventor to the position of sole creator at best exaggerates his influence over events, and at worst denies the involvement of those humbler members of society without whose work his task might have been impossible. (p.287)"

Burke specifically rejects the standard textbook treatment of history in terms its reliance on "heroes, themes, or periods. (p. 287)" The first, or heroic approach, ascribes innovation to people that are deemed special, and who are lauded as "inventors," but such an approach, in Burke's view shows the innovator in unrealistic isolation from the environment in which he achieved something new. Newton seemed to take the same view in having once said that he was only able to achieve what he did because he "stood on the shoulders of giants." The second, or "themes" approach to history is, according to Burke, the categoriziation and division of the record of past knowledge or achievement into neat, but unrealistic categories, such as transportation or communications. As Burke points out, this approach ascribes to the 'inventor' an unlikely degree of precognition as to how and where his or her invention would "fit." A third, flawed approach, is the "periodic treatment," in which events are divided into historical periods, such as "the Middle Ages," or chunks of history encompassing the reign of a specific monarch or president, as though the change of the bureaucratic guard had a specific effect on innovation or acquired knowledge. (p.288) The real danger, Burke says, is that these three approaches to the study of history can cause people to develop a "linear view" of how change happens, and that such a linear view leaves people ill-equipped to understand the process of change when they see it happening. If people have a linear view, they may expect that (1) a "genius" has to come along to change things effectively; (2) that a "genius" or "inventor" would just know, in advance, the kinds of application for which the invention he or she is working on would be used; and (3) that innovation would occur in a generally orderly and continuously progressive manner, or that specific calendar or government changeovers would necessarily result in things being "different" for the innovator than they were before.

Burke's "Web" Theory of Change

Burke's "Web" theory can be summarized as a belief that scientific discoveries or technological advances come about by means of a process that involves an interconnected "web" of knowledge, and people, and events. The point at which a new idea, or a realization of a significant connection, occurs is a moment when someone makes the right "connection" between things that often have been present or publicly available for a long time, just not in that particular context, combination, or application. Further, Burke suggests that individuals' personal lives and experiences are continually coming into connection with one another's, so that -- particularly as communication methods advance to keep more and more people in closer contact with one another -- we are all interconnected in one another's lives. (p.292)

Burke agrees that there are reasons for innovation to occur, such as "greed, ambition, conviction, happenstance, acts, of nature, mistakes, and desperation." (p.*viii*) However, generally, change -- in the past -- has been due to a series of "serendipitous" events, and more often than not, the "lonely genius inventor" has been a myth. Instead, most innovations have been brought about by the actions of generally "normal," everyday people with "average" intelligence, working with others cooperatively. (p.291)

Burke also points out that "the ease with which information can be spread is critical to the rate at which change occurs." The more and the faster information spreads, the faster innovation happens. (p.291) Burke says, "Every time there is an improvement in the technology with which ideas and people come together, major change ensues. ... This process has been at work, with extraordinary results, during the brief lifetime

of this book. When it was first printed, in 1978, there were no laptops, personal digital assistants, electronic agents, World Wide Webs, commercial on-line services, or cellular phones. That is a measure of the speed and scale with which change is now beginning to happen, as the Information Age advances." (p.*viii)*

Burke's Ideas About Innovations, Compared to Rogers'

Burke and Rogers have very different approaches to innovation and the diffusion of innovations. Burke is generally interested in the "innovators" more than the process of diffusion of their ideas or the products developed using their ideas, which is Rogers' primary interest. Burke particularly concentrates his focus on how the general knowledge-base, or at least the knowledge base of the scientific community of whatever historical period he's discussing, advanced just far enough so that -- when the right person was at the right time and observed the right thing -- that person made the all-important "connection" of the various loose ends into a new way of thinking about something or saw how to make a machine or other practical application of the idea.

Burke, in the original *Connections,* most closely agrees with Rogers in his agreement that "break-through" innovators are generally better educated people. Burke focuses on historically significant innovators whose ideas were well known to others in the scientific or educational community and recognized as advances. Rogers, by contrast, uses the term "innovators" to discuss those in a community who first adopt new ideas or equipment, recognizing or anticipating that these are advances that will bring some specific benefit to them or to their work.

Burke's historic "innovators" are often members of the scientific community of their day, often people who know as much as is available to be known in the time in which they live. These are people who are routinely looking for new ideas, and thus they know a good idea when they stumble over one. However, the diffusion of the idea after the innovator gets it and does something specific with it is not Burke's major interest, as it is Rogers'.

Burke's focus is on the creative idea or the adaptive leap -- how one idea "connects" to another -- by (usually) one person, a "discoverer" or an inventor -- or, since the "connection" is often how an idea or apparatus in use in another field can be adapted to a new application, this person is a "re-inventor," in Rogers' terms.

Burke, metaphorically, is saying that the "knowledge base" of any one time is like a "sea of knowledge" that everyone works and lives in. As Burke sees it, we're all connected in a "mental plasma" of diffused ideas, applications, and understandings -- as if, in our modern culture, we were all part of a huge, amorphous, amoebic creature. Innovators, generally better educated and looking for new ideas, are on the outer boundaries of this general-culture membrane. When they come in contact with a "new" idea, the innovators recognize that this is a new connection -- and, by a sort of intellectual osmosis, they pull the new idea "through the membrane," and introduce it into the diffused "plasma of ideas" that everyone shares.

In general, Rogers would probably consider this approach overly fanciful, but he would probably agree with the "through the membrane" part, with this activity ascribed to those who, in Rogers' view, are the "early adopters" or even, perhaps, "opinion leaders."

Burke's "Web" Theory of Innovation, Compared to Others'

The "interconnectedness" of ideas and the "serendipitous" nature of innovation have interested many thinkers, particularly with the acceleration of the changes and inventions of the Industrial Revolution -- a time of rapid social and technological changes that, in some ways, resembles our own time of accelerating change. Hegel, for example, noted that the "zeitgeist" or spirit of an age, being more oriented, for example, toward change, encouraged more change to occur. He also noted, as an interesting phenomenon, that the more strongly the "spirit of an age" favored certain types of advances, the more likely several innovators -- even if they and their research interests were unknown to one another -- were to come to the same conclusions, or even to figure out similar practical adaptations of an idea almost simultaneously.

Carl Jung, describing the same phenomenon in the cultural or social-psychology arena, described this as "synchronicity," attributing the impact and subsequent diffusion or adoption (in Rogers' terms) of "new"

cultural ideas or their symbolic representations as evidence that an innovator (often an artist or writer) was often uniquely gifted in tapping a "collective unconscious" of ideas, symbolic meanings, myths, and psychological pre-sets shared by all humans. Jung also said that -- psychologically speaking -- there is no such thing as "coincidence."

Arthur Koestler, in his book investigating the origins of innovative thinking, *The Act of Creation,* says that in order for a truly creative idea to occur, there must be an almost literal "creative leap," a cross-over of ideas from one "plane," or context, of thinking to another. For example, Koestler points out that such a "collision" of contexts is absolutely essential for humor to work, and that such a clash of contexts must be a creative "surprise" in order to catch us unawares and make us laugh.

Burke is in full agreement with these ideas. In fact, he might find it amusing that to some extent the popularity of his *Connections* series can be attributed to the fact that the ideas of these and other thinkers, ideas he is building on, have been diffused widely in the general culture.

Implications for Educators of Burke's Theory of Innovation

While Burke (and Rogers) would agree that no one can educate a person to *be* an innovator, both agree that education plays a pivotal role in preparing someone to *become* an innovator. The educated person, one who has a larger-than-average "knowledge base," is far more likely to be one who generates a "new" idea -- or recognizes an idea as a new "connection" and adapts or uses it for an innovative purpose -- and who understands the ways in which it *is* a new idea and its implications for advancement, improvement, or change in whatever context to which it is being applied.

Constructivist theory -- the currently popular theory in education that focuses on helping children to construct meaning from their own, authentic experiences -- is particularly appropriate to the training of a future generation of innovators. Constructivism focuses on helping students to recognize implications of ideas and the contexts to which that idea may apply. Burke, however, would probably caution that -- although authenticity and immediacy of experiential education models is important -- content, or the "knowledge base" -- particularly of core-curriculum subjects such as math, science, language arts, and history --is also critically important.

Innovators of tomorrow must be both aware and knowledgeable -- and both of these "preparation areas" are the primary concerns of education. In a recent presentation at Nortel, Burke summed up his expectations of education in preparing students to handle the world of tomorrow, a world in which the unwary can drown in "a tidal wave" of information, one that Burke predicts is coming and that Burke calls "information surge."

Burke says, "Only an educated electorate will be able to make informed decisions about the social changes that will be triggered by information surge in the next century. To meet this requirement, education itself will need to change. Schools and universities will need to replace their outdated reductionist forms of learning with the cross-disciplinary knowledge necessary for riding the information networks of the future. We will primarily need to take a new attitude to the matter of intelligence and qualification. Just as Gutenberg's book brought the need to be able to read, the new systems will require the ability to navigate the network rather than to know things, to be able to retrieve data rather than remember it. A life-long qualification in a single discipline will be meaningless, and along with it will go the habit by which people characterize themselves according to the job they do. New systems give minds new things to do. So, maybe for the first time, the next information surge will encourage minds to think in idiosyncratic ways that were never possible before. It may free every human being's hundred-billion neurons to express themselves in ways not limited by the availability of paper and ink or the requirements of examinations. We can only guess at the surge effect of this release. Nobody knows what a fully empowered individual can do, because there has never been one. But it is urgently necessary that we begin immediately to use information technology to prepare us for the eventuality." (Nortel, 1997)

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Self-Efficacy Beliefs as an Indicator of Teachers' Preparedness for Teaching with Technology

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Abstract: The focus on information technology in education has shifted towards curriculum integration. Consequently teacher education programs need to prepare graduates for teaching with IT. Graduates should possess both skills in the use of IT and belief in their capacity to integrate IT into teaching. Decisions about course design might be informed by a measure that is directly influenced by course changes and also indicates likely long term outcomes for teacher behavior. Self-efficacy beliefs can provide such a measure especially in the context of preparing teachers to teach with technology.

Introduction

Beginning in 1984, Queensland State governments introduced a series of funding initiatives to promote the use of information technology in schools. Early initiatives promoted the provision of equipment to support courses that would prepare students with the skills for participation in an increasingly technological workplace. Initial funding to establish laboratories for teaching computer literacy was followed by special purpose grants for Business Education Centers and Electronic Learning Centers in specialist subjects such as Art and Music. The first general funding provision for computers in primary schools came about ten years after the first secondary program, with the goal of increasing access to computers in the final two years of primary school. In many respects this represented a continuation of the focus on workforce preparation by developing basic skills before entry into secondary school.

More recently the emphasis of Queensland government initiatives in relation to information and communication technology (ICT) in education has shifted focus. Funding is still being provided for purchase of equipment but the new focus for its use is on integration into the curriculum. In the words of current Queensland policy, information technology should be applied "to effective learning and teaching in all key learning areas, P-12" (Education Queensland, 1998b).

The implications for schools and teachers are considerable. A requirement for students to develop work related computer skills could be accommodated through separate classes taught by specialist computing teachers. Other teachers were under no obligation to develop or apply knowledge and skills in the use of ICT. However, the new expectations effectively require that every teacher should integrate technology into his or her particular curriculum. The associated changes in teacher knowledge and skills will need to be addressed through professional development for the existing teaching workforce and through initial teacher education programs for future teachers.

Teacher education institutions, employer groups and governments are seeking to address these issues using strategies such as technology standards for teacher education programs (DfEE, 1998; NCATE, 1992). In Queensland, the most recent policy initiative included competencies that are to be achieved by all teachers in the state education system within the three year span of the program (Education Queensland, 1998a). Although there is, as yet, no stated requirement for graduating teachers to meet these standards prior to employment it seems likely that employers of teachers will soon expect that applicants are not less capable than current employees in respect of ICT. Thus the requirements mandated for serving teachers are likely to represent a de facto requirement for graduates and hence a baseline consideration for course planning in teacher education.

Preparing Teachers to Integrate Technology

Teacher education faculties have grappled for years with the challenge of preparing teachers to integrate technology using a variety of different approaches. Brownell (1997) reviewed published research about technology in teacher education which appeared between 1990 and 1995. She concluded that there seemed to be consensus that technology is important and that teacher educators need to serve as role models. However, there was little hard evidence to guide the development of effective programs and she called for more evaluative research on technology in teacher education programs.

One of the difficulties facing developers of teacher education programs is that, although the true measure of their success is in the work which will be done by teachers some years in the future, decisions about the design of courses must be made in the present. Some components of the knowledge and skills required for teaching with technology can be assessed with reasonable confidence. These include technical skills such as the operation of hardware or software and knowledge of relevant curriculum and policy documents.

Many teacher education courses have been graduating beginning teachers with these capabilities for several years. However, research suggests that this does not translate into more or better integration of ICT into teaching. Oliver (1993) found that beginning teachers who had formal training in the use of computers as a personal tool did not differ in their use of computers for teaching from their peers who had not had the training. It is at least arguable that there are factors other than technical knowledge and skill which contribute to teachers' success at technology integration in their teaching.

If teacher education programs are to be effective at increasing teachers' capability for integrating technology, then decisions about the structure and content of those courses need to be based upon an understanding of the factors which contribute to successful technology integration. An appreciation of those factors should permit their development to be traced and the design of courses to be adjusted to achieve the desired outcomes.

It may also be possible to identify one or more measures which are directly influenced by experiences in teacher education and which, in turn, predict success at technology integration either directly or through their influence on other factors. Such measures would be especially helpful in the design and evaluation of teacher education programs where one of the challenges is to make decisions which are implemented immediately while accepting that the ultimate effects of those decisions may not become apparent until some years after graduation.

This paper argues that teachers' beliefs are a significant factor in their success at integrating technology, that self-efficacy beliefs are an important, and measurable, component of the beliefs that influence technology integration and that particular instructional strategies might be effective for increasing self-efficacy beliefs relevant to technology integration.

The Importance of Teachers' Beliefs

Teaching frequently involves solving ill-structured problems which are characterized by a large amount of information, open constraints and the absence of a single correct solution (Voss & Post, 1988). Nespor (1987) argued that the ill-structured nature of many of the problems encountered by teachers resulted in teachers' beliefs playing a major role in defining tasks and selecting strategies because, unlike other forms of knowledge, beliefs can be flexibly applied to new problems. He suggested that, rather than reflective and systematic study in the course of teacher education, it seemed "likely that some crucial experience or some particularly influential teacher produces a richly-detailed episodic memory which later serves the student as an inspiration and a template for his or her own teaching practices" (p. 320). Pajares (1992) found that there was a "strong relationship between teachers' educational beliefs and their planning, instructional decisions, and classroom practices" (p. 326) and that "educational beliefs of preservice teachers play a pivotal role in their acquisition and interpretation of knowledge and subsequent teaching behavior" (p. 328). Indeed, it seems that "beliefs are far more influential than knowledge in determining how individuals organize and define tasks and problems and are stronger predictors of behavior" (Pajares, 1992, p 311).

Decisions made by teachers about the use of computers in their classrooms are likely to be influenced by multiple factors including the accessibility of hardware and relevant software, the nature of the curriculum,

personal capabilities and constraints such as time. However, there is substantial evidence to suggest that, teachers' beliefs in their capacity to work effectively with technology are a significant factor in determining patterns of classroom computer use. Honey and Moeller (1990) interviewed 20 elementary and secondary school teachers and found that teachers with student-centered pedagogical beliefs were successful at integrating technology except in cases where anxiety about computers prevented them from appropriating the technology. In contrast, teachers with more traditional beliefs faced much greater change in their practices in order to integrate technology. A case study approach to the use of computers by four special education teachers found that for the most part they adapted computers to meet their overall goals and fit their routines with their beliefs and attitudes strongly influencing how the computers were used (MacArthur & Malouf, 1991). Marcinkiewicz (1994) found that of a number of personal variables, self-competence (belief in ability to use a computer for teaching) and innovativeness (willingness to change) were most closely related to computer use among 170 elementary teachers. Studies of computer use during teaching practicum (Albion, 1996; Downes, 1993) have found that, despite possessing positive dispositions towards computer use, pre-service teachers lacked confidence in their capacity to teach successfully with computers.

Defining and Measuring Self-Efficacy Beliefs

The construct of educational beliefs is broad and for research purposes has been refined into more specific sub-constructs (Pajares, 1992). Examples include beliefs about confidence to affect students' performance (teacher efficacy), about the nature of knowledge (epistemological beliefs), about perceptions of self (self-concept) and about confidence to perform specific tasks (self-efficacy). The latter is of particular interest because of the role it is proposed to play in determining behavior.

According to Bandura (1997), who first described the construct, "perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3), and such beliefs are the most central mechanism of personal agency. As proposed by Bandura, self-efficacy is specific to a particular set of behaviors and comprises two components, efficacy expectations and outcome expectations which respectively relate to belief in personal capacity to effect a behavior and belief that the behavior will result in a particular outcome. As a consequence, instruments for the determination of self-efficacy typically include two scales to measure these two components.

Bandura's claims about the importance of self-efficacy beliefs in explaining behavior have been supported by research in a variety of contexts, including general health behaviors, treatment of phobias, self-regulation of pain, academic performance and career development (Bandura, 1986). Perceived self-efficacy with respect to computers has been found to be an important factor in decisions about using them (Hill, Smith, & Mann, 1987) and increased performance with computer related tasks was found to be significantly related to higher levels of computer self-efficacy (Harrison, Rainer, Hochwarter, & Thompson, 1997). An instrument including several sub-scales for self-efficacy in relation to particular aspects of computer use has been developed and validated with students studying business, nursing and education (Kinzie, Delcourt, & Powers, 1994). A recent study confirmed the reliability of the instrument and found that the most significant predictor of self-efficacy for computer use among teacher education students was frequency of computer use (Albion, in press).

Gibson and Dembo (1984) developed an instrument to measure teachers' sense of efficacy for teaching. Subsequent studies have linked this construct to patterns of classroom behavior known to yield achievement gains (Dembo & Gibson, 1985) and have shown it to be positively related to change in individual teacher practice (Smylie, 1988), ratings of lesson presentation, classroom management and questioning (Saklofske, Michayluk, & Randhawa, 1988) and teacher success in implementing innovative programs (Stein & Wang, 1988).

A more specific Science Teaching Efficacy Beliefs Instrument (STEBI) developed by Riggs and Enochs (1990) has been used to investigate the impact of variations in course design on elementary science teachers (Watters & Ginns, 1997). The STEBI was used by Enochs et al. (1993) as the basis for development of a Microcomputer Utilization in Teaching Efficacy Beliefs Instrument (MUTEBI) which was used in the evaluation of a staff development program designed to encourage microcomputer use in science teaching [Borchers, 1992 #210]. That study demonstrated that when teachers' self-efficacy beliefs in their ability to use

computers were increased through appropriate professional development they were more likely to incorporate computers into their teaching strategies.

Although there do not appear to be any other studies which specifically link self-efficacy with computer use in teaching, several studies (Albion, 1996; Downes, 1993; Handler, 1993; Summers, 1990) have identified lack of confidence for teaching with computers as a factor influencing the levels of use of computers by student and beginning teachers. Marcinkiewicz (1994) also reported that teachers' use of computers for teaching was related to their belief in their ability to do so.

Taken together, the studies referenced above point towards teachers' beliefs and, in particular, self-efficacy beliefs, being useful indicators of likely success at technology integration. Certainly they provide sufficient reason to undertake further investigations in this area and to consider what approaches to teacher education and professional development might be effective in increasing self-efficacy for teaching with technology.

Influencing Self-Efficacy Beliefs

According to Bandura (1986) self-efficacy beliefs develop in response to four sources of information. The most powerful influence on self-efficacy is "enactive experience" in which self-efficacy for a behavior is increased by successfully performing the behavior. The second most powerful influence is "vicarious experience" in which other similar people are seen to perform a behavior successfully. A third source of influence is verbal persuasion, which, if realistic, can encourage efforts that are more likely to increase efficacy through success. Finally, self-efficacy beliefs can be affected by physiological and affective states such as stress.

From the standpoint of self-efficacy theory, the ideal method for developing teachers' self-efficacy for computer use would be to provide them with training and support to work successfully with computers in their classrooms. The study conducted by Borchers et al. (1992) demonstrated that a professional development program which included several workshops over an extended period and on-site support for participants could be effective for increasing both self-efficacy and computer use.

In the context of a teacher education program, enactive experience and resultant increases in self-efficacy might be achieved through successful experiences with the use of computers during field experience. In practice, variations in the experience and expectations of cooperating teachers and in the availability of equipment make it impossible to ensure that all students will experience the success that builds self-efficacy beliefs. Vicarious experience through direct observation of experienced teachers engaging in appropriate behavior poses similar logistical difficulties and verbal persuasion has limited application unless students have opportunity to perform the appropriate behaviors.

These logistical problems might be overcome by developing multimedia materials to make examples of effective classroom use of technology available to a wider group than could participate in direct observation. Whether delivered by web (Bronack & Kilbane, 1998) or on CD-ROM (Kurth & Thompson, 1998), such materials find theoretical support in a rich literature base on case methods in teacher education (Carter & Unklesbay, 1989; Merseth & Lacey, 1993; Shulman, 1986). Viewed from a self-efficacy perspective, the mechanism of the case method corresponds most closely to vicarious experience in which self-efficacy is increased through consideration of examples of successful performance by others. The inclusion of multimedia elements in the presentation of a case adds layers of detail that are not possible with a purely text description.

Self-efficacy theory suggests that real experience is more effective than vicarious experience for increasing self-efficacy beliefs. Thus it seems reasonable to suppose that multimedia case designs which encourage increased involvement of the user in the case should be more effective at increasing self-efficacy beliefs.

Problem-based learning (PBL) is one approach to instructional design that appears to warrant investigation for this purpose (Albion & Gibson, 1998a). When students succeed in creating solutions to the authentic problems of practice which are the focus of a PBL sequence their experience should include more of the characteristics of enactive experience and thus be more powerful than vicarious experience as a source of self-efficacy beliefs. Interactive multimedia materials using a PBL design have been developed (Albion & Gibson, 1998b; Albion & Gibson, 1998c) and will be evaluated for their effects on teacher education students' self-efficacy beliefs for teaching with technology.

Conclusion

As community expectations for integration of information technology into the daily practices of teaching grow, it will become increasingly important that all teachers are adequately prepared for this dimension of their professional practice. Research suggests that teachers' self-efficacy beliefs about using technology for teaching are directly related to their practice. Measurement of self-efficacy using appropriate instruments may provide a useful indicator of the effects of teacher education initiatives intended to better prepare graduates for technology use. Moreover, self-efficacy theory may offer insights into the development of materials with more powerful instructional designs.

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Anchorage Consortium for Technology and Teacher Training (ACT^3)

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Abstract: The Anchorage School District and the University of Alaska engaged in a two year process to identify teacher competencies in the area of technology, develop a set of standardized courses to provide these competencies and establish a framework of student performance indicators. The credit classes were then linked to the teacher competencies and the ISTE standards. This session will describe the process used to accomplish this task.

1. Introduction

The Anchorage School District and the University of Alaska formed a partnership designed to streamline the process of providing staff development to teachers in the Anchorage School District. The two year project included:

- a list of technology competencies for all teachers;
- Professional Development Courses designed to provide training opportunities for teachers to gain those competencies;
- Student Technology Framework, including grade-level indicators tied to national and state technology standards;
- the infrastructure at the University that facilitates the implementation of professional development courses.

2. Background

The Anchorage School District has more than 48,000 students and 3100 teachers. Professional development in the district consisted primarily of state release time for in-service training, after school workshops and university credit courses. The primary source of technology teacher training in the district was a collection of unrelated professional development courses through local universities. Courses were proposed and taught by anyone who submitted a course outline, which resulted in inconsistent quality, redundancy and gaps in content. As more classroom computers became available, the need for technology training dramatically increased . With this increase, the responsibility for these staff development classes fell into the job description for the coordinator of instructional technology. It became very evident that the process needed revision to meet this growing demand.

Prior to the formation of this partnership (ACT^3), a new course outline needed to be submitted and had to be approved by the university each time a course was offered. There was no system to provide consistency from course to course, to map relationships between courses, or to repeat courses without going through the entire approval process. The course outlines had no identified relationship to teacher competencies or national technology standards. All course approvals required eight weeks or more once they were submitted to the university. There was no system to pre-approve an inventory of courses. This process was time consuming and labor intensive. Each course outline was based on the idiosyncrasies of the individual instructors because there was no mechanism to collaborate or communicate with each other. This paper outlines the partnership that was formed and the system developed to provide a comprehensive standards-based curriculum which facilitates effective use of technology in the classroom, and timely, efficient course approval.

2. The Process

3.1 Year I

In the spring of 1996, the voters of Anchorage failed to pass a technology bond issue by a margin of 2:1. One of the basic criticisms of the district's technology plan was the lack of a comprehensive teacher training plan. In the fall 1995, as a result of budget cut-backs, the responsibility for managing the technology-related credit course was transferred from the district-wide Training & Professional Development Department to the Instructional Technology Department. After a year of coordinating the process as described above, it became obvious that changes were needed. Initially, the goal was to organize a list of approved credit courses. However, it was determined that the real need was to identify the instructional technology competencies that all teachers needed, from which a consistent set of course outlines could be developed.

In the fall of 1996, Sharon Bandle, Instructional Technology Coordinator, formed a task force of 24 technology leaders from across the Anchorage School District. The mission of the task force was to identify the technology competencies necessary to integrate technology into the classroom curriculum and to effectively use technology to enhance teaching and learning. Dr. Helen Barrett, educational technology faculty member in the University of Alaska Anchorage School of Education, facilitated the process. The group met for twelve three-hour Saturday morning sessions over the course of a school year, and earned up to three professional development credits. The task force reviewed previous credit course offerings and the Curriculum Guidelines for Teacher Preparation Programs in Computer/Technology Literacy developed by International Society for Technology in Education (ISTE) for NCATE.

After reviewing other examples of teachers competencies (e.g., North Carolina), the group developed a list of topics and skills Anchorage teachers needed to enhance student learning using technology in the classroom. The competencies were identified in the areas of curriculum integration, basic operations, productivity tools, multimedia and telecommunications. In the process of identifying the various competencies, it became apparent that there were also several skill levels that needed to be addressed, which were identified as: Introduction, Overview, Application and Integration. The courses that were written fell into one of these four skill levels. As a group, the decisions were made about what course topics were needed to provide the identified competencies. Each course topic was placed at the appropriate skill level. When consensus on courses was reached, training was provided to the committee members for elements to be included in the course outlines. The group was divided into teams and each team was responsible for writing a set of related courses. As course outlines were completed the group as a whole critiqued each proposal for content. At the close of the school year, the committee had created the list of teacher competencies and 22 credit course offerings that would help teachers acquire the identified competencies. By developing these course outlines, the participants in the task force also became qualified to teach these courses.

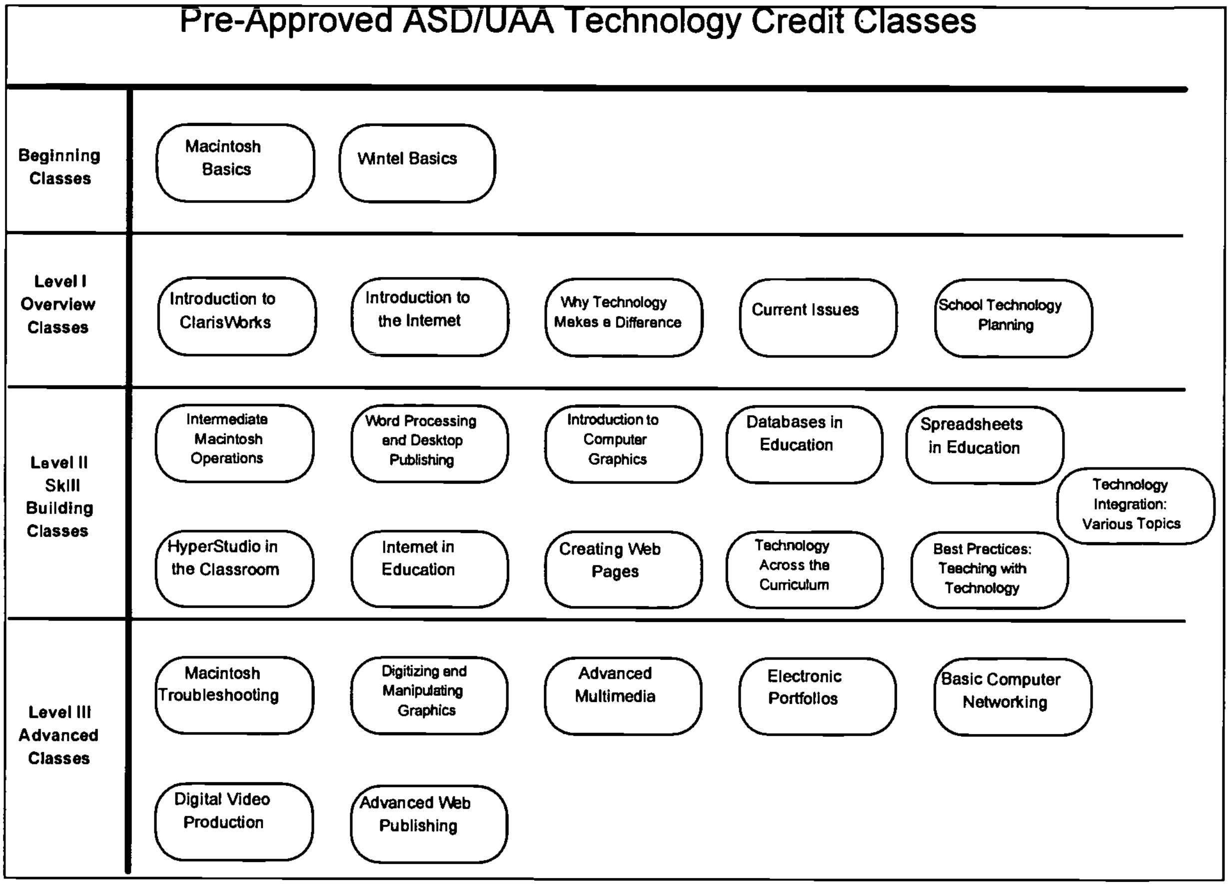

Figure 1: Courses Approved by Level

Three graduate students from the University of Alaska revised the Course Content Guides over the summer providing a consistent format and linking them to the district technology competencies and the ISTE standards. The following is a chart which includes the credit courses and their skill level placement. After the course outlines were finalized, they were reviewed and approved by the University of Alaska Anchorage School of Education and assigned permanent course numbers. Once the courses were in the University of Alaska Anchorage's course inventory, the Professional and Continuing Education (PACE) Department, worked with the Anchorage School District to streamline the process of scheduling these courses and registering students. Because of the system set in place by the University, a credit class can be scheduled by a single phone call to the PACE office and the course can begin as soon as it is scheduled in the University's computer, which can often be done on the same day.

3.2 Year II

The Technology Leadership Task Force met again the fall of 1997. The meetings were again held on Saturday mornings throughout the school year, and participants worked toward three graduate credits. The mission for the second year was to establish a student technology framework including grade-level indicators tied to national and state student technology standards. This process included the review of numerous web sites and district student performance indicators as well as the emerging National Educational Technology Standards (NETS) under development by ISTE. Once identified by teachers at different grade-levels (i.e., primary, intermediate, middle and high school), the indicators were grouped into three main domains: Basic Operations and Concepts; Tools for Communication and Research; and Social, Ethical, and Human Issues. There was a strong consensus to connect these indicators to the state technology and content standards. The group was divided into sub-groups by content areas (language arts, social studies, math and science) and grade levels. Each group identified the performance indicators when introduced, reinforced and mastered by grade level. The following is a representation of the relationship among the age/grade levels, the technology skills and the content area standards.

After identifying the student performance indicators, the grade-level teams developed Units of Practice which integrated the acquisition of technology skills with standards-based curriculum units. A few of the task force members also developed a framework for their portfolio which demonstrated their achievement of the NCATE standards for a basic endorsement in educational technology.

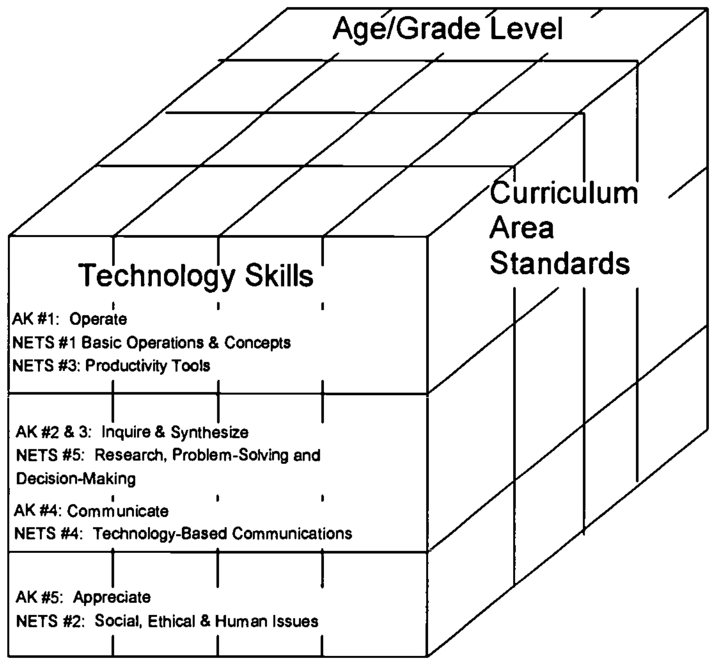

Figure 2: Anchorage School District Technology Framework

4. Results

- As a result of the efforts during the first year of the project, 74 credit classes were offered to the district teachers with 800+ teachers attending. Each one of the 22 credit course was offered at least once during the year. In addition, with funds provided by a federal Technology Literacy Challenge Fund Grant, 61 of the credit courses were offered to Anchorage School District teachers and administrators during the summer of 1998 with 747 participants. There are 55 credit course which have been offered or will be offered during the 98-99 school year with an anticipation of an additional 30 to be scheduled by individual schools. In two years, Anchorage School District teachers have doubled participation in professional development courses sponsored by the University of Alaska Professional and Continuing Education Department. Prior to 1996, there were very few courses offered to Anchorage teachers by the University of Alaska Anchorage.

- With the teacher competencies in instructional technology clearly identified, the Anchorage School District now had guidelines for the skills required of new teachers. The Executive Director of Personnel endorsed the process and supported requiring these technology competencies, once identified, of all teacher applicants.

- Furthermore, as a result of this collaboration, pre-service education about instructional technology changed dramatically. Prior to 1995, there were no required technology courses for pre-service teachers. Today, undergraduate education majors must take a two credit Foundations of Educational Technology course; graduate students are required to take one of several three-credit graduate courses in educational technology. Prior to 1995, there was no permanent faculty member responsible for educational technology; in the fall of 1996, Dr. Barrett was appointed to a tenure-track position, responsible for educational technology

undergraduate and graduate programs. As a result of communication with the Anchorage School District, a plan for developing a competency-based endorsement in educational technology, based on the NCATE standards, was also designed. In addition, a M.Ed. Master Teacher with Emphasis in Educational Technology was approved by UAA in the fall of 1997.

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Oregon State Technology Standards-- http://www.oetc.org/b1.html

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North Carolina Technology benchmarks (LEARN North Carolina): http://www.learnnc.org

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Blueprint for Success: Teachers and Technology

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Abstract: From 1993, the Education Network of Ontario has grown from eighteen to sixty thousand registered educators, half of the eligible teachers, administrators, teacher trainees and elected education officials in the province. This report details a variety of implementation stories - the building of financial support, qualitative and quantitative analysis of users and activities, classroom and educator projects, and successful technical changes as the project moved from text-based, terminal emulation Internet activities to web-based mail, conferencing, and model curriculum and classroom projects.

The paper illustrates what teachers do as professional development from home, from school and from Faculties of Education whether as pre-service, in-service or post-degree teachers. Included are the curriculum projects that educators develop and how the Education Network of Ontario continues to stimulate award-winning development at every level. Practical tips to entice even the most telecommunications-resistant teachers are illustrated since this project is now working with those educators who do not adapt to change or technology readily.

Introduction

The initial stage of the Education Network of Ontario (ENO) was a UNIX-based, cross-platform, TCP/IP protocol distributed network application which provided bilingual (English and French) electronic mail, moderated conferencing (facilitated newsgroups), and database and Internet access across Ontario. It started with just eighteen members in 1993 and has grown to register more than sixty thousand teachers, administrators, trustees and education faculty, nearly half of the K-12 education personnel of the province. The project migrated to Web-based conferencing, electronic mail, document publishing and classroom projects. We have learned a great deal about how educators use this suite of services. Presently, we are coaching over six thousand students engaged in teacher-devised classroom projects. Their personal and project work is published on-line for their families and communities to view.

Financial Support and Management

The primary client of the Education Network of Ontario is the Ontario Ministry of Education and Training. Originally, the Ontario Teachers' Federation, the professional union organization of the 115,000 teachers of the province, mentored the organization. It is now an independent non-profit corporation with a fully functioning Board of Directors. The core funding has grown from $200,000 to over $4,000,000 per year as more teachers, administrators and students use the services. The corporation has become so entrepreneurial that the total budget is over $5.5 million. The federal level Youth Employment Program funds the training program in which unemployed or under-employed teacher graduates are employed for several months in specific schools to assist with telecommunications skills and resource development. The Ontario Ministry of Energy, Science and Technology will fund research into IP Telephony which is not just technology exploration in a relatively narrow band infrastructure but also implementation exploration from a human resource and training perspective relative to new technologies.

There is a very small central management staff of eight with a trained field staff of approximately 60 who moderate newsgroups, initiate technical exploration and classroom curriculum projects, and train colleagues in their home environments in either English or French. In the coming months, there will be a continuing emphasis on training teachers, administrators and students throughout the province. Moderated newsgroups, the private professional environment, universal access, and educator-originated projects continue to differentiate ENO's service from other Internet Service Providers or bulletin boards.

Technological Partnerships

The vast majority of the budget is allocated to infrastructure development and maintenance. Many of our more successful partnerships arise from investigation and implementation of new services and equipment. This allows ENO to do more technical development, implement better solutions, assess unique pieces of equipment, or acquire in-kind licenses or services.

For instance, AT&T Canada works with ENO to create the most cost-efficient '800 service' which allows members to access ENO using long distance lines without enormous costs. In doing this, we are using software-based switching and blocking to bar local users from abusing 'free' long distance lines. We will progress to using this service to build in automatic redundancy should one of our thirty (30) points of presence or 'POPs' fail.

We are working with 3Com/US Robotics to implement digital technology using innovative 'rack-mount' modem chassis with built in routers and management tools. ENO finds this new equipment cost-effective because it reduces errors and client support costs. It also allows ENO to serve specific clients with access to ISDN-level speeds. We are involved in the Canadian program of beta testing 3Com hardware and software in the IP Telephony project.

We signed an agreement to work on Internet videoconferencing with White Pine, the company developing the videoconferencing software, CUSeeMe. A software and implementation solution by ENO was compensated with a licensing agreement. This technology may then be integrated with the IP Telephony project to move administrators and politician-trustees from face-to-face meetings to PC-based meetings with shared applications and workspace.

Technical Issues

The network has a base wide area network (WAN) of thirty points of presence or 'POPs'. Each POP is a remote access system capable of analogue V.90 and digital ISDN connections and is comprised of a Pentium II UNIX server running online services and authentication. Each had a minimum of 23 modems. These POPs are connected in a Wide Area Network using frame relay at speeds to T1 to a backbone infrastructure. ENO's backbone is Gigabit Ethernet on Layer 3 switches connected via ATM to the Internet. The mail, conferencing, and web access all use off-the-shelf protocols and software to maintain the open systems standards and avoid ongoing software and upgrade fees. The major proprietary piece is the authentication server since few other networks are authenticating over 60,000 members to selective services depending on whether they are students or adults, and the activities to which they are subscribed with transparent, province-wide access.

Users can dial a 'POP' from anywhere in the province free of charge and establish standard PPP connections enabling graphical display with a standard browser such as Netscape Navigator or Microsoft Internet Explorer. Members may also establish a text-based connection if they do not have a graphics-capable machine or wish higher speed access to documents without graphics.

Of course, members can access the system from the web site and be authenticated to the Intranet or private conferences through the authentication server. Thus the project can present services to a much larger

number of members than would be possible through dial access alone. ENO separates Internet access from Intranet services and allow members to use their home, commercial, or community access points.

Statistics and Effects

During a typical month, more than thirty percent of these 60,000 teachers, administrators, trustees, technical and support staff, education faculty, their students, and Ministry of Education officials participate. The network logs over 5000 dial participants a day and over 4 million minutes a month of connect time. A typical moderated conference, an Intranet newsgroup, generates several thousand threaded, searchable messages within a few weeks. To handle this volume of access and activity in such a large geographic area, we have modified the software from a simple bulletin board application to an integrated, Web-based suite of tools on a system of thirty instantly updated servers throughout the province. However, the objectives remain those of a tightly knit education community: equality of access, pedagogic integrity and classroom-based action research.

Almost since the beginning of the project, women have participated at a level of 30% or higher. In fact the number of women in the group of those who access once a week or more is higher than that average. This reflects other projects which have investigated gender and women's participation in professional Internet activities.

Reasons for Success

Major factors in the system's success have been the freedom enjoyed by all participants and a supportive government grant structure. The ability of educators to use the facilities at any time of day, from both sophisticated and minimal machines, from school, library or home, in both English and French makes the process relevant for both classroom activities and lesson discussion and preparation.

Educators share a personalized environment of professional conferences selected from a list created by them and moderated and maintained by colleagues who receive a small honorarium or modest time relief. Members change their newsgroup subscription list to reflect personal changes in interests or needs.

As well as the assistance and encouragement they receive from the on-line moderators, teachers receive an active program of orientation and training about telecommunications from early navigation of electronic mail and the conferencing system to document retrieval from Internet sites and educational servers.

ENO's focus on creative classroom projects using connectivity among students and teachers continues to provide impetus to teacher participation. Personal student access codes have been a great success for the 10,000 students who have participated thus far.

ENO has a fully bilingual telephone support service and is busy creating a 'support' web structure with a registration page, traditional frequently asked questions, and modem and browser settings.

Activities

The major activity of the teachers continues to focus on the moderated conferences that they open to solve such endemic concerns as 'local' versus 'standardized' evaluation, reporting to parents, community work/learn programs, and general subject-based or level-based curriculum issues. A second established use occurs whenever a new provincial license for software is purchased. A conference is opened in which the technical support team from the vendor can discuss issues of use and technical implementation with teachers throughout the province.

Smaller groups of teachers voluntarily initiate a series of professional activities such as writing primary school curriculum units themed on two-dimensional measurement. A typical and very successful example

is the web-based project devoted to showing young students how to conceptualize two dimensions with a central fictional character called 'flat Stanley'. After the provincial collaboration, teachers mount the curriculum units on an ENO web site. Those who create the material then update and maintain it. The project is now international with hundreds of schools participating.

Administrators are creating a centralized resource of activities for teachers and administrators of northern schools who have no outside student recess for as long as six weeks in mid-winter. Teachers create a file of model parent letters and report cards for middle school students during a period of education reform. The network has a forum for school administrators in which teachers who wish to be administrators are mentored concerning effective career paths. Teachers, with education faculty and students, work on computer literacy curriculum units, plan professional development conferences, and hold meetings of subject-specific committee executives. One school of over two thousand students used the system for its internal electronic mail, information distribution and meeting scheduler. Another district's school custodians are working on practical identification and warnings about workplace issues and hazards.

Currently, we are developing on an on-line course about telecommunications in which templates for classroom activities are discussed, implemented in specific classrooms and improved for the system as a whole. Our largest project to date is an online environment to assist the Canadian National Marsville Program, a project based on intermediate-level students creating a living environment for the pioneer astronauts and settlers of Mars. Students are uploading their air, water and food supply system drawings to their team's web pages. They access mentors' comments from Spar Aerospace and the Canadian Space Agency. They communicate with one another to prepare for the final 'link-up' day. Using this on-line environment prior to the main event enhances classroom learning activities.

Summary

Because ENO's funding is limited, we continuously seek support from individual grants and strive to use resources outside of our small staff complement to accomplish tasks. For instance, we share points of high-speed access with other public sector agencies and ministries. Special educational projects and district school boards purchase infrastructure or conference 'space' and moderation. We are instrumental in providing Ontario student access to the federal program, SchoolNet and look forward to greater integration with a more national SchoolNet implementation of ENO's Intranet newsgroups.

As we stabilize our network and work toward province-wide direct dial and school access, we look forward to fulfilling our potential as a ubiquitous background tool for elementary and secondary education in Ontario. Our implementation focus concerns student projects and environment and our organizational focus is on financial sustainability. Our technical focus is increased access, speed, reliability, and functionality through continuous experimentation with new modem, server and transmission equipment and technologies.

Diffusion of Educational Technology: Teaching and Collaborative Education

Walter Heinecke, University of Virginia, USA
Dorothy Vasquez-Levy, University of Virginia, USA
Laura Blasi, University of Virginia, USA

A new classroom is emerging as teaching styles influence the use of instructional technology across a distance. In a panel along with Jerry Willis and Rhea Walker from Iowa State University, we will discuss interactive technology from the instructor's point of view, in the context of a course design joining Iowa State University and the University of Virginia. The course was created through the combined vision and time invested by professors from Instructional Technology , Research and Evaluation, and Curriculum and Instruction. This session is to be complemented by a session designed by graduate students who participated in the course.

Course Overview:

The content of the course focused on technology and policy. Participants in the University of Virginia's *Diffusion of Technology : Policy and Practice* explored the nature of the to educational-technology policy process in two states. A s a collaborative effort between Curry School of Education at the University of Virginia and the College of Education at Iowa State University, the research conducted on this course over the Fall semester of 1998 provides us with a window into what happens when different teaching styles have an impact on the use of IT. IT, as it is used for collaboration over a distance, is shaped by each instructor's teaching preferences at the same time it requires the classroom dynamic to depart from the lecture format.

The technology was configured to accommodate each instructor's approach to teaching in our Collaborative E-learning Laboratory (CEL). Our two-way white board and on-line conferences using NetMeetings, was augmented Collabora Newsgroup discussions. In the course of the discussions, the content determined when and how technology would be appropriate. *NPR* audio files and *Washington Post* articles available through the Web quickly become part of the course's evolving syllabus. A document camera was

implemented when the lack of face-to-face communication was raised as an impediment to holding deliberative discussions at a distance.

Before we could look at how we were doing this, we surveyed our options to plan what we would do. This plan evolved over the semester. The following chart by Glen Bull offers a range of options for schools considering Collaborative Learning, but concerned about costs:

Designing a Collaborative Education Laboratory (Three Examples)			
	Inexpensive	Low Cost	Moderate Cost
Whiteboard	NetMeeting Software Whiteboard (free)	Graphics Tablet ($200)	Electronic Whiteboard ($2,000)
Real-time Audio	NetMeeting Internet Audio (free)	Full-duplex Conference Phone ($300)	Conference Phone with Wireless Mike ($1,000)
Projector	Scan Converter ($300)	LCD Tablet ($1,000)	Projector ($3,000)
Real-time Video		NetMeeting + Video Digitizer ($70) and Video Camera ($150)	NetMeeting + Video Digitizer ($70) and Camera & Tripod ($1,000)
Document Camera		Adapted Video Camera (no additional expense)	Video Digitizer + Video Switch ($20) + Document Camera ($1,000)
Streaming Audio		SoundBlaster ($60) + Sound Recorder Software (free) + NetShow	SoundBlaster ($60) + Sound Editing Software ($50) + NetShow
Discussion Group		Internet Discussion Group (Collabra) – (free)	Internet Discussion Group (Collabra) – (free)
Total	> $500	> $2,000	> $10,000

A second class held between Iowa and Virginia, *Philosophical Foundations of Instructional Technology*, from Iowa State University consisted of a dozen students at one site and a half-dozen students at the other. Classes of this size would have formerly been too small to be economically feasible. The rationale underlying the Collaborative Education model is not efficiency or cost savings, but creation of a richer, more diverse class than otherwise would have been possible.

The Collaborative model, which evolved from our work across a distance, challenges traditional definitions of distance education, in which one instructor might lecture via video to a passive audience or administer the entire course through Web-based fill-in-the-blank assignments. Collaboration over a distance required that teachers facilitate more often than lecture, as Newsgroup exchanges during the week outside of class meeting times became an asynchronous possibility.

Drawing from qualitative research, we intend to share our lessons-learned regarding course structure, computer-mediated communication, and the change in pedagogy that occurs when a course is constructed towards effective collaboration at-a-distance.

Instructor Perspective:
Walter Heinecke, University of Virginia, USA

Context:

As an affiliate professor in the educational technology program at the University of Virginia I teach a course on educational technology policy every two years. The course is aimed at doctoral students who want some of the policy background conditioning the implementation and use of educational technology in classrooms. When I first taught the course two years ago I was new to the profession and had no experience teaching in higher education. I did not employ any technology the first year I taught the course. I was and still consider myself to be a low to moderate technology user. I consider myself to be still working on becoming a proficient classroom teacher. I worry about such issues as the balance between lecture, discussion and student participation. I worry about remaining sensitive to the needs of my students and reaching them through various learning modalities.

Setting:

The class was small and this was due to our tentative treatment. The class had not been advertised in the class schedule or through announcements. Many students did not know when the class would be meeting and this affected the enrollment. I had no connection with the ISU enrollment process. The class dynamics were influenced by student characteristics, by the novelty of the technology, and by the nature of the computer-mediated communication. The technology seemed to change weekly. Some of this was by
my design as instructor. In other words, I would teach the class and recognize that certain limitations hindered my ability to naturally teach the course. From my perspective I was trying to make the technology seamless and invisible. During my portion of the course the classes were still fairly teacher-centered. As I mentioned I was still struggling with basic teaching issues and as I was learning the technology I was using it in fairly conventional modes.

Changing expectations:

We were able to make changes so that I could get documents and charts scanned in and used for presentations. We struggled with the intergroup communications issues. I found it difficult to be talking at the speakerphone rather than at images of the students at ISU. I think if the speakerphone were more naturally aligned with the video image that would have improved communication. We also struggled with the room arrangement. It seemed to change weekly and I couldn't get used to it as an instructional environment. In the last few weeks we had problems getting all participants on the video screen. I think group CMC got better as time went by. The conversations and discussions seemed to flow more naturally and people all had assigned tasks for readings and discussion. My colleague was definitely better at collaborative teaching than I and the technology appeared to work for her in terms of student directed presentations and discussion. I think we could have done better at student use of the technology. The course was more teacher centered than it could have been. The technology made me more conscious about how I taught. It forced me to think about using all the technological resources available to me as an instructor. It

also forced me to deal with issues of student collaboration. I was continually concerned about issues of involvement and how the technology might be affecting class participation. In summary, I feel that this technology has tremendous potential for opening modalities of instruction previously closed to traditional distance education. It is extremely useful for small seminars in which collaboration and interaction are central.

Instructor Perspective:
Dorothy Vasquez-Levy, University of Virginia, USA

Context:

In the late 1980s I was first using Bitnet and setting up listservs for students in my teacher education classes to use for discussion. I don't want the discussion to end when students leave the room. Every semester I set up a closed, on-line discussion group, and this discussion component is an integral part of the class. I use the internet as a way for students to interact with many types of information. For example, I ask students to assess Web-based subject content by considering such factors as its selection of ideas, forms of representation, and coherence and justification of content. I use many types of technology to conduct research and write, and this is the 10th year I have been studying a closed discussion group I established while in graduate school. I have used CuSee-Me technology to take my class on-line discussion groups a step further. I have students read the most recent work by educational researchers and then "meet" with these researchers in class via electronic networks. I do not see computer technology as just another tool or delivery mechanism. "I want to create interactive technology environments that will allow students and teachers to interact in ways that they couldn't otherwise."

Changing expectations:

I believe instructional/human considerations should be considered before - during - and at the conclusion of any class. The technology component should be a means of thinking about and advancing the teaching and learning of the participants -- thus accomplishing teaching and learning in ways that would otherwise not be possible.

Diffusion of Educational Technology: Student Perspectives on Collaborative Education

Laura Blasi, Univ. of Virginia, USA
Lori Howard, University of Virginia, USA
Lisa Washington, University of Virginia, USA

The Course

Participants in the *Diffusion of Technology*: *Policy and Practice* explored the nature of the to educational-technology policy process in two states, enriched by voices and experiences across a span of a thousand miles. This presentation by graduate students complements the session focused on pedagogy and the instructor experience. The Web, conference calls, and other interactive technologies gave us the opportunity to design this course as a collaborative effort between Curry School of Education at the University of Virginia and the College of Education at Iowa State University. We began by addressing the policy process related to educational technology, and then moved to focus on diffusion of innovations in educational organizations. Our goal was to examine and policy factors influencing the successful implementation of educational technology in Iowa and Virginia, but along the way we learned several valuable lessons which have contributed to our developing model for Collaborative Education.

The Technology

Throughout this semester-long course we configured the technology to accommodate the instructor's approach to teaching in our Collaborative E-learning Laboratory (CEL). Our two-way white board and on-line conferences using NetMeetings, was augmented Collabora Newsgroup discussions. A second class held between Iowa and Virginia, *Philosophical Foundations of Instructional Technology*, consisted of a dozen students at one site and a half-dozen students at the other. Classes of this size would have formerly been too small to be economically feasible. The rationale underlying the Collaborative Education model is not efficiency or cost savings, but creation of a richer, more diverse class than otherwise would have been possible.

The Students and Environment

At the heart of our model for Collaborative Education has been the hope of sparking synergy by helping a variety of perspectives to intersect across a range of media. We began with six students. Their sense of investment in the course varied – as some took the course for credit and others audited. This did have an impact upon participation. They way students found out about the course and became involved also had an impact. Since we were only trying out this technology for the first time, we had a small group and momentum was difficult to maintain. This was made especially challenging by frequent interruptions as observers entered the classroom or as technological glitches required attention. Our students had varying levels of content experience. *Diffusion of Technology* included a former member of the educational standards board in one state and the co-chair of the commission that developed the technology standards for instructional personnel in another state, both serving as resources as the course was taught.

Changing the Architecture of Academic Courses

As Gail Hawisher and her colleagues have explained, "Many students who know a teacher is observing their conversation will self-discipline themselves and their prose in ways they consider socially and educationally appropriate. Constructing such spaces so that they can provide room for positive activities -- for learning, for the resistant discourse characteristic of students thinking across the grain of convention, for marginalized student voices -- requires a sophisticated understanding of power and its reflection in architectural terms" (64). We have only begun to understand more clearly the change in architecture when two-way video and computer-mediated

communication are introduced into a course. This panel complements and earlier session focused on the changes in teaching styles and perceptions. This panel focuses on the student experience while in a collaborative course held at-a-distance.

Malcom R. Parks exploring earlier negative reactions to the use of text-based technologies for on-line discussions in the *Journal of Communication* has cited research on the effect of time allocation in on-line discussion: "Walther and his colleagues found that the proportion of socio-emotional content was higher when interaction time was not restricted (Walther et al., 1994). Thus, the negative effects attributed to the computer as a medium may have instead been the result of the stringent time restrictions placed on interaction (82). In addition to the two-way video, our use of computer-mediated communication, in Newsgroups, was shaped by the restrictions created by students derived from their own concerns and expectations – as much as the interactions were shaped by the modelling provided by professors.

We have found that collaboration is difficult when new technologies are introduced, even if the students have experiences with IT. This seems to be partially because of the new skills needed, but is also a result of the challenge such a change presents to each students' fixed idea of how a course should unfold and what kind of contributions and collaborations they are used to and expect to make towards a class. Our presentation will include discussion of the paper writing process. We found that a new model developed as we shifted to coordinate research and writing without a high level of physical interaction, and while writing in a format that was easily accessible over the Web. The hesitancy students may feel towards trying out new approaches for collaboration may make instructors more reluctant to try new things, if students are not readily flexible. On the other hand this challenge reminds course facilitators to address cultural issues early-on in the class and explicitly state their expectations. This should occur at the same time that the instructor tries to determine student expectations and norms towards academic work. While our evaluation of the medium is still unfolding, we have seen that student comfort-levels with autonomy are influenced by their learning styles, but these levels are also shaped by the level of specificity given towards developing course objectives and expectations. The impact of these levels are felt across the distant sites, depending upon the degree of contact fostered among and towards students who are not physically in the same room as the instructor.

Student Perspective: Lori Howard
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Context

Currently, as a doctoral student (Educational Psychology) I am involved as a research assistant with a computer based teaching decision simulation. This teaching decision simulation will be available in a Web based format in the future. Due to my past experience and interest in technology, I enrolled for the Diffusions of Innovations course. At the time of my enrollment, I was unclear that this would be a distance education course. Upon learning that the course would use Internet II technology and Net meeting, I was very positive because this course was providing me with a personal experience as a student with distance learning. My main reason for taking the course was to broaden my understanding of how technology policy is made and implemented in K-12 classrooms. The content outlined in the course syllabus was very intriguing to me and provided an opportunity for me to expand my knowledge base about how technology effects the classroom environment, while expanding my personal knowledge of the impact of technology on the learning environment.

Setting

Due to the innovative nature of the class, it seemed to me that the technology itself was the focus of class during the beginning of the semester. I believe that the technology was enhanced and changed to create a better situation over the course of the semester. Initially, two way communication was established via a speakerphone. As a student, this required greater effort on my part to concentrate on my classmates in Iowa. I missed having body cues and faces to connect with voices. Later in the semester, two-way video connections were established. The first video pictures were somewhat unclear and I found it distracting to see my classmates in Iowa because the video and audio were often out of sync. I vividly recall, the first occasion when the video was clear and I had a crisp image of Rhea

Walker because it seemed that this was the first time I actually "met" her. For me, this is when the class began to gel and I understood how learning could be enhanced with technology. The class also used a web-based discussion group to exchange ideas and to comment on readings. Initially, I found myself hesitant to post my thoughts. During the course of the semester, I began to post more often, but the discussion group did not provide me with human feedback.

Observations

Initially, I felt that all class members would need to demonstrate goodwill and patience for this technological approach to learning to work. I retain positive feelings toward my classmates despite feeling that I haven't gotten to know my Iowa classmates. I was surprised to note my own ambivalent feelings toward the use of technology. Ironically, the very technology that seemed to be enabling me to collaborate with classmates in Iowa felt as though it was creating a distance between us. The discussion group which was established to help us function as a group felt artificial to me. I never felt a sense of "self" with the other posters to the list and admit that I was uncomfortable sharing my myself with the others.

I also noted that as a student, my normal learning style needed to be modified. I am very dependent upon metacognitive structure and often found it difficult to follow conversations with people I could not see. Participation in class demanded that I actively participate in ways that were different from other seminar classes I have taken. Specifically, I tend to be a conceptual thinker and often lose focus with too many details. In this class, I found it helpful to come to class with a general conceptual framework rather than develop one during class.

Lessons learned

I have learned that more research may be needed in to the impact of individual learner differences and the use of technology. Specifically, not all learners may benefit from distance education type courses. In addition, I developed great admiration for the faculty involved as they were flexible, open to change, and supportive of the student efforts with technology in this class. They were great role models for how teachers should incorporate technology without fear and with a willingness to make mistakes.

Student Perspective: Lisa A. Washington
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Context

Beyond my use of computers for personal productivity, I am a graduate instructor of a project-based software applications course that teaches students how to use the Microsoft Office suite of applications including Word, Excel, Access, and PowerPoint. The course also provides instruction in developing Web pages, Internet searching, and digital image capture and manipulation. In addition to my position as a graduate instructor, I teach similar computer applications courses to in-service teachers and pre-service administrators. My interest in the *Diffusion of Educational Technology: Policy and Practice* course was twofold. First, I was interested in further exploring the ideas of Everett Rogers, to which I had been exposed in a previous course. I also have an interest in policy implementation and wanted to be exposed to thoughts and literature related to the development and implementation of technology policy. I am particularly interested in the trickle-down effects of policy and the transformation of policy interpretation into policy in practice. I was also interested in experiencing a shared learning experience across distance. I wanted to know what it would be like to learn and share in a distanced education environment.

Setting

In the first few weeks of the course only a speakerphone and white board connected students at the University of Virginia (UVa) and Iowa State University (ISU). Unlike a traditional seminar where formality and courtesy often take a back seat to allow for the active and free flowing exchange of thoughts and ideas, the sharing of these same

thoughts and ideas via telephone introduced a series of what I considered unnatural, albeit courteous, pauses between each speaker. A Netscape Collabra discussion group served to keep the students connected outside of class. I was not an active user of the discussion group. I was much more comfortable posting information to the group than I was posting my reaction to a particular reading or responding to questions posed by the instructors or other students. My resistance to using the discussion group had to do with not being able to take back my words once they were posted and not being able to see others' reactions to what I had posted. In a face-to-face discussion non-verbal communication plays a key role in interpreting others' thoughts and there is an opportunity, absent in Web-based discussions, to receive immediate feedback or provide explanations to expressed thoughts. Once the video was introduced I did not feel more connected to the students at ISU. In fact, I felt distracted by the slightly out of sync audio and video transmission. I preferred to sit in a location that did not give me a direct view of the monitor on which we were viewing the ISU students. By the time the video was set up I felt that I already knew the ISU students by their voices and it was a distraction to watch them on a monitor while I was trying to listen to what they were saying.

Observations

There were times throughout the semester when I felt very detached from the ISU students. I felt as though we were actually two separate classes instead of one. My previous experience in seminar classes is that relationships among class participants develop and flourish outside of class. Opportunities for informal meetings and interpersonal communication in between class sessions foster this development; opportunities that are absent in a course offered across distance.

Lessons Learned

I learned that I have an aversion to online discussion groups and as such, regardless of the course content, I am not inclined to seek out future distance education courses that require such participation. I much rather prefer to interact with people, instructors and other students, in person. For me, part of the learning comes from face-to-face interaction with the people with whom I'm sharing my thoughts and ideas.

I feel I may have benefited more from the learning experience if I had been paired with one of the ISU students, rather than working all semester in a group with the UVa students. I think that particular class dynamic contributed to my feeling that we were two separate classes. Creating mixed pairs of student groups could have promoted more collaboration and a greater appreciation for varying perspectives on our class project.

The inauthentic communication created by interacting across a distance was the most significant difference of this experience for me, as compared to a traditional classroom setting. We were all very polite—we did not speak over each other nor did we interrupt or speak out of turn—and waited a noticeably extended period of time after someone had finished speaking to begin speaking. While it tapered off after the video connection was made, we almost always identified ourselves before we began speaking. I appreciate the power that the telecommunications and video technology we used has to connect students and faculty across distance, however the power of face-to-face interpersonal communication should not be forgotten in the evolution of this technology.

Curriculum Standards: Identifying Instructional Sites and More

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Infusing the use of technology into the school curriculum is not an easy task. Educators want to know how they can do this when they already have much to do and they must use the STANDARDS. This ongoing project matches curriculum standards with web sites, tool software, curriculum-based software and other resources.

Students at this state university have developed and are continuing to update links to instructional resources that support various curriculum standards. The students have studied the standards, explored the Internet, reviewed and evaluated software, books, and other resources and have created a web page that will give educators what they are looking for - assistance with the infusion technology into the curriculum.

The use of this project is as simple as 1,2,3...
1. Go to the web page or CD-ROM.
2. Click on curriculum area of interest.
3. Click on grade level.
4. Click on standard.
5. Select resource.

Supporting Teachers in Technology Education: The Computer Clubhouse Approach

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Abstract: The creation of technology rich learning environments is a common goal of today's educational institutions. For this goal to be realized, it is generally assumed that teachers and/or administrators need to be competent in using technology in meaningful ways. The authors argue that there are two avenues that are generally taken when pursuing this objective: an administrative "top - down" approach that attempts to directly infuse technology into the classroom and a "bottom - up" approach where individual teachers with interest are encouraged with the hope that this interest will slowly spread throughout the school. With preliminary results from a network of middle school computer clubhouses, the authors discuss the possibility of a third "backdoor" approach utilizing student interest in technology.

The creation of technology rich learning environments is a common goal of today's educational institutions. For this goal to be realized, it is generally assumed that teachers and/or administrators need to be competent in using technology in meaningful ways. Currently there are two avenues that are generally taken when pursuing this objective. The first is an administrative "top - down" approach. This typically includes a purposeful infusion of technology into the classroom through the purchase of computers and providing teacher training. The second is a "bottom-up approach" where technology is not intentionally introduced, but individual teachers with expertise, sometimes encouraged by the administration, generate interest from their colleagues through the sharing of information and resources. It is hoped that this active involvement will generate momentum that will result in school-wide technology adoption. Either of these approaches may or may not be successful.

Community Computer Clubhouses introduce an alternative "backdoor" approach. This method utilizes student interest in technology. Computer access and education is provided to students outside of the classroom through after-school Computer Clubhouses in combination with community support and involvement. Computer Clubhouses provide a safe, after school, learning environment for middle school students. It is hoped that as students gain technological proficiency they will become a resource to peers, teachers and the community. Computer Clubhouses could then accomplish the goal of providing technologically rich learning environments as a result of developing

teachers into effective users of technology by not only providing the necessary computer technology but also through the support of student technicians and a collaborative effort with the community and other schools.

A Network of Michigan Middle Schools has developed a consortium of nine districts that sponsor ten (10) Computer Clubhouses with technical and managerial support from a large mid-western university. The middle school Computer Clubhouses will serve these urban and rural communities as 21^{st} Century Community Learning Centers and form an innovative virtual statewide learning community through a Web-based network.

The districts where these clubhouses are located, represent remote, sparsely populated and core urban areas and are characteristic of a wide range of geographic and demographic diversity. They all have large percentages of students who fail on indicators of academic achievement, receive special academic assistance, and have the potential to be victims of violence and drugs. A majority of the districts report that 30% to 90% of their students are living within the poverty range based on data compiled by the Michigan Department of Education. Students from these communities have limited employment potential and expectations as they move toward adulthood.

Parents in these communities are demanding that schools improve academic achievement for their children and curb violent behavior, substance abuse, including alcohol, tobacco, and other drugs, and teen pregnancies. Reported incidences of teen violence are increasing; yet, in these communities, there is very little for middle school students to do after school, over weekends, and during the summer. In a study of the quality of life in one of the small rural school districts, findings suggest that 25% of the students are at risk at school, at home, and in the community. The principal reports that "several students do not want to leave the school at the end of the day". These communities and the other communities in this consortium are struggling to find ways to improve community support for education, offer safe, positive after-school environments for middle school students, and increase student engagement in learning.

The intended purposes of the Community Computer Clubhouses are to:

1. Increase student engagement in learning through the use of computers and computer-related technology in safe, positive environments,
2. Provide meaningful, integrated, and authentic learning opportunities through service learning,
3. Foster the capacity for collaboration among students, schools, and communities among the project partners and their communities,
4. Develop an innovative model of statewide collaboration for building student and staff capacity through the sharing of resources.
5. Provide a safe learning environment during and after school hours.

The Computer Clubhouse approach is unique in that it does not apply a "top - down" approach to developing technologically literate teachers - infusing the school/district with technology and training teachers. Neither, is it a "bottom up" approach - mandating classroom use of technology but, allowing and even encouraging its use when introduced indirectly. The Computer Clubhouse "backdoor" approach is directed at student development of the necessary technical skills required to educate their peers, educational staff, and the community.

This roundtable submission will highlight the preliminary findings related to teacher technology use associated with Clubhouse endeavors. Discussion will center around the implications these preliminary results may have on the future direction of the Computer Clubhouse method as well as teacher technology education in general.

Technology adoption at the college level: Multiple representations of technology integration

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The College of Education at Michigan State University has developed and implemented a highly innovative environment for integrating technology in teacher education. Rooted in a deep understanding of teacher learning and technology adoption, this model strives to achieve and sustain systemic change in teacher education and K-12 learning through creative use of technology.

This poster presentation would provide an opportunity to showcase and describe numerous innovative initiatives aimed at preparing a new generation of K-12 teachers, teacher educators, and educational administrators. These initiatives address human and technical infrastructure, research and development, and teacher education projects. Listed below are five such programs we would like to highlight, in hopes of providing direction and support in the drive towards integrating technology into teacher education.

TechGuides

The TechGuides are a group of graduate students employed by the College of Education to provide expert technology and technology-based curriculum advice to teacher educators and teacher candidates. Under the leadership of Yong Zhao, the TechGuides help teacher educators become technologically fluent educators.

Additionally, the TechGuides maintain a Web site, publish a newsletter, and provide a Kiosk on teaching with technology. TechGuides are also encouraged to study the process by which teachers and teacher educators integrate technology into their teaching.

eWeb

eWeb, an integrated Web-based learning environment, consists of a set of Web server plug-ins that work with a Web server and database applications to offer a suite of multi-functional tools in an integrated fashion for teachers and students to use within a Web browser. Within this environment, the learners are enabled and encouraged to explore, experiment, and experience independently and collaboratively with their peers from the same or other schools. Tools are also provided to help students develop metacognitive skills and become goal-oriented, self-regulatory, independent learners.

eWeb has been used by teacher educators in the college to support class projects and model pedagogical uses of advanced technology. eWeb has also been used to support research on virtual communities, teacher reflective discourse, distance learning, and other issues.

Community Computer Clubhouses

This project seeks to establish an innovative consortium of ten (10) middle school clubhouses in nine rural and urban school districts (two in Detroit) to serve as community learning centers. Michigan State University (MSU) will provide technical and managerial support to consortium. The school districts represent the demographic and geographic diversity of Michigan, but they are all struggling to increase student engagement in learning, offer safe, positive after-school environments for middle school students, and improve community involvement in the schools. Computer clubhouses present a powerful intervention strategy for solving those pressing problems and achieving four overarching project goals:

1. Increase student engagement in learning through the use of computers and computer-related technology in safe, positive environments,

2. Provide meaningful, integrated, and authentic learning opportunities through service learning,

3. Foster the capacity for collaboration among students, schools, and communities among the project partners and their communities,

4. Develop an innovative model of statewide collaboration for building student and staff capacity through the sharing of resources.

Through the resources of edtech.connect, a technology outreach initiative of the College of Education, the middle school clubhouses will access research, best practice, and on-site assistance for engaging all students in authentic learning experiences. For the students, the clubhouses will provide safe in learning environments, teach them to help others, and expand their horizons by sharing across the consortium network.

Reading Classroom Explorer

The Reading Classroom Explorer (RCE) is a hypermedia environment which contains video clips of reading classrooms, transcripts, questions to ponder, further reading resources, and an interactive notebook. The video footage of exemplary teachers teaching reading (at this point, all video is on loan from the Center for the Study of Reading's "Teaching Reading: Strategies from Successful Classrooms" 6-part video series) drives users' inquiries. RCE aims to broaden preservice teachers' opportunities to observe

children and teachers from different cultural backgrounds, environments, and theoretical perspectives.

RCE provides multiple examples of successful teachers who are teaching thoughtful curriculum to students of diverse backgrounds. Through RCE you can explore a variety of literacy practices (e.g. literature-based, phonics, whole language, emergent literacy, basals, writer's workshop, etc.). The video clips demonstrate teachers using a variety of instructional formats (e.g. small group, large group, discussion, etc.) while working with students in grades K-5 including ESL and special needs students.

The videos, accompanying questions, and transcripts provide teachers with opportunities to learn more about reading and writing instruction. Preservice teachers can use RCE not only to see multiple approaches to literacy instruction but also to compare and contrast those approaches. RCE provides opportunities for professional development for inservice teachers as they view and reflect upon the teaching of others. Teacher educators can use RCE to help bridge gaps in theory and practice by providing real world portraits of literacy teaching and learning.

Expert Database

The EXPERT database is a database-driven Web site aimed at assisting teachers with technology problems by giving them access to experts. To become a user of the system, you may register your name, password, and area of interests, as well as areas of expertise. You may then ask a question under a certain category which is automatically sent to whomever is listed as an expert for that category. When the expert responds to your question, you are immediately notified by email. However, the answer is also stored in an on-line database. Future goals include making the system "intelligent" such that you will be able to ask the system a question and it will first check the database for an appropriate answer prior to asking an expert. It will also increase the usability by allowing the user to rate the appropriateness of the particular response.

The EXPERT database is one example of the numerous research and development projects at the College aimed at providing teachers and administrators with the cognitive tools they need to implement technology in education.

A Multi-Stage and Multi-Component Program Plan to Integrate Computing and Technology into a Division of Education

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Abstract: The effective integration of technology and computing tools by faculty into the courses offered by their Division of Education must take full advantage and make use of as many resources as are available or can be made available. In the this paper, I will describe the multiple stages and the many components of a long range technology plan that several faculty members and I developed and have continued to develop, implement and assess. I will also describe several of the problems with which we have had to contend and some of the solutions we have used. Throughout this ongoing process, we have been guided by the principle that improved student learning must guide our plan and its implementation and progress.

Introduction

We are a Division of Education composed of approximately 40 full-time faculty members, divided into three departments (Early and Elementary Education, Secondary Education, and Specialized Services in Education). We primarily serve six community school districts and the Bronx High School Division. Our Division prepares and trains a sizeable number of the preservice teachers who must qualify for a provisional licensing status so they can begin teaching. We also offer several master level degrees to a large number of the same provisionally certified teachers and to others who must earn a masters in New York State in order to qualify for their permanent teaching license.

For the past two years, we have been engaged in the committed development of a five year Technology Plan that is now guided by parameters that perhaps best describe the anticipated 21st century classroom that our N12 teachers must be prepared to enter. We must prepare our preservice teachers and inservice teachers to become problem posers, problem solvers, effective users of telecommunications and information technologies (Dede, C., 1998), and literate information users (Breivik, P.S., 1998) in the evolving global communities that will characterize the 21st century.

> Today's workplaces and communities – and tomorrow's – have tougher requirements than every before. They need citizens who can think critically and strategically to solve problems. These individuals must learn in a rapidly changing environment, and build knowledge taken from numerous sources and different perspectives. They must understand systems in diverse contexts, and collaborate locally and around the globe (Jones, F.B., Valdez, G., Nowakowski, J. & Rasmussen, C., 1995, p. 5).

This is for us a very significant and critical challenge to meet and one that will take time, effort, and patience to attain. How have we as a Division begun to move to meet this challenge?

Within Our Division of Education: Building Toward the 21st Century Classroom

The best approach we have found in creating and implementing a technology plan that supports the ideals of the 21st century classroom, is a problem posing, problem solving approach that allows for the creation of constructive initiatives and as much participation by the many potential collaborators as possible. The specific goals and objectives have been defined by ISTE (1998) for all preservice teachers being prepared for the 21st century classroom

Developing a Technology Plan Guided by Student Learning

Following our participation at the 1998 Dean's Forum on Technology in Teacher Education, sponsored by NetTech (the Northeast Regional Technology in Education Consortium), we began to more seriously contend with the problem to have student learning and student performance outcomes direct and guide a Division Technology Plan. NCATE's (National Council for Accreditation of Teacher Education) representative at the Dean's Forum made it very clear to all participants that, unless student learning outcomes were improved, what then were the real and actual benefits of a technology plan? Upon returning to the College, I began to reshape and reframe our developing technology plan to meet NCATE's recommendations. Through many discussions, our Division has come to accept that the 21st century classroom as described above represents K12 performance outcomes that we must prepare our faculty and their preservice and inservice teachers to meet.

Building a Division Infrastructure that Support Faculty Initiatives

Teacher education faculty cannot be expected to prepare their students to enter into the 21st century classroom unless they are familiar with such a classroom and supporting infrastructure. Although by Spring term, 1997, all faculty had desktop, internet-connected computers, many of these were of the 386 to 486 model and simply out-of-date. Grant funds were obtained and all faculty have since been upgraded to Pentium II multimedia stations, with intranet and internet capability. In addition, we have upgraded our Division server to a Windows/NT server, added a newer version of listserv software for each faculty to create a listerv for courses and projects, added ease-of-use webpage software, and recently added Internet course software for those faculty interested in placing all or a portion of their courses online. Faculty can now include software in their department and Division supply requests.

In order that faculty integrate technology and computing tools into their courses, as many flexible resources need to be provided as possible. One of our earlier goals was to provide faculty with access to laptops and portable projectors that can be easily plugged into intranet/internet connection located in all classrooms. Even though six such connections are going to be provided by the College by June 1999, the laptops and projects are not yet ready and may not be for a while longer. However, we also realize that projectors and laptops only allow for demonstrations and the more traditional lecture format. Our students need as much hands-on experience as possible to be prepared for their role as teacher-as-facilitator rather than teacher-as-lecturer. Therefore, rather than using our available funding for the lecture-type setups, we decided to build two additional computer classroom for general use and a specialized classroom for science and mathematics instructions. These classrooms can now be made available for faculty to use for classroom instruction across the content areas and to simulate the three to four computer station setup found in many K8 classrooms. This will require that our faculty learns to plan for the effective integration of technology and computer tools into their content areas. This will take a predictable two to three years.

Faculty Development

Beginning Spring term, 1998, I have been given one course release time to provide faculty with faculty development workshops and one-to-one assistance to develop competencies to use their new multimedia stations and, most importantly, to plan how best to integrate technology and computer tools into classroom instruction. We designed our professional development workshops based on faculty needs assessments and focused on their readiness to learn. In the workshops, I stressed the importance of their identification of performance outcomes to improve their work as faculty and to improve the learning of their students. Since we do not have funding for an actual faculty developer support staff and I am the only assigned faculty developer, I decided that a team approach would allow faculty to consider themselves as collaborative team members. I based this decision on a K12 professional development model that I have been working with for a number of years. For example, when questions arose during a workshop, I would deliberately request other faculty members to provide assistance to their colleague. Or when a faculty member would stop me in the hall with an application problem, I would suggest that they also remember that one of their colleagues would know how to solve the identified problem.

For the Spring term, 1999, we will provide faculty with opportunities in department meetings and in Division meeting to present and discuss how they are integrating technology and computer tools into their courses and to discuss how their use of these resources will support and extend students' learning. In these presentations, faculty will be able to share their initiatives, receive support and feedback, and, through discussion, develop ways to possibly extend their current uses. Also, the presentations will allow other faculty a non-threatening place to discover ways to develop and borrow tried and tested approaches.

Undergraduate Student and Graduate Student Preparation

In attempting to meeting ISTE's (1998) recommended technology and computing competencies, we quickly realized that far too many of our undergraduate preservice education students and master's level students were leaving our Division and entering schools without adequate technology preparation. Since many of our faculty have only within the past year begun to integrate technology and computing tools into their courses, students would, of course, not receive the quality and quantity of hands-on preparation needed. We do provide all students, graduate and undergraduate, with email accounts, but there is no guarantee that they are using these accounts at this time. A few faculty regularly use email with their students and there is much interest in attaching listservs to courses. This would not necessarily guarantee that all of our students become proficient users. Another problem compounding this is the fact that two-thirds of our undergraduate education students transfer to us at the junior level from community colleges. And for students entering our masters programs, we find that they no better prepared than our undergraduate students.

This is a major problem for us to solve and requires several approaches. At the graduate level, students admitted to the masters program in Elementary Education are required to enroll in a newly redesigned technology and computing course. This course makes extensive use of the different forms of electronic communication, the diverse range of software to support instruction, and the resources made available via the Internet. Students are also carefully guided in the evaluation and review of software and Internet applications in their design of curriculum that meets the revised standards of the New York City Board of Education and New York State Dept. of Education. However, this is only one group of our graduate students.

Recently, we designed a new undergraduate course for all preservice teachers that meet the ISTE standards. All undergraduate students declaring education as a minor in their junior year (both transfer and continuing students) must either demonstrate these competencies or must enroll in a course in which the competencies are taught. For those students who have passed their junior year, they must, before beginning their student teaching, demonstrate these competencies or enroll in workshops to acquire the competencies. We do not want the community school districts reporting to us that some of our students are not technology literate.

We are still struggling to design approaches to guarantee that all of our master level students have acquired the basic ISTE standards. This will take additional planning and a concerted effort by our faculty.

Taking Advantage of Campus Technology Initiatives and Facilities

Since we are only one Division with limited resources, our best hope to develop and implement an in-depth technology plan is to collaborate closely with the other College divisions, departments, and programs. These collaborations have few costs except for time and have brought partnerships in grant writing and program development. Also, our students must be able to make use of all available resources and our collaboration with the rest of the College makes this possible. For example, we have developed collaborative initiatives with the Library (which is now fully electronic), the Information Technology Center (which includes three distance learning facilities), and other facilities, including Continuing Education. We are also a partner with the BIN (Bronx Information Network) which provides extensive infrastructure support to local school districts (N through 12 grades), medial facilities, community organizations, and

Creating K12 Collaborations to Support the 21st Century Classroom

As a Division of Education, we, of course, do not function in isolation to Bronx school districts, community organizations, and businesses. And in reality, the Division is in actuality playing catch-up to the initiatives and efforts of our neighbors. So, our effort became to take the best advantage of these realities and to build then into the Division's technology plan and efforts.

Advisory Committee of Technology Coordinators

In April 1997, I formed a Technology Coordinators' Advisory Committee of the six Bronx community school districts and the high school division to provide suggestions and recommendations to the Division on its technology planning. This group has proven to be a valuable resource for they have their finger on the pulse of the technology needs of the Bronx schools. They have given me valuable feedback on the development of a technology and computing specialization and concentration and recommended the formation of the Bronx Superintendents' Technology Leadership Forum (to be discussed below). Selected technology coordinators from this group now either teach some of our technology/computer courses or have recommended school computer coordinators and/or classroom teachers for these positions.

Best Practices Technology Schools

Another area that the Technology Coordinators' Advisory Committee has been extremely helpful in identifying N12 "best practices technology and computing schools" for our Division faculty and their students to visit or for the teachers of these classes to visit the college classes. This arrangement allows our faculty to take the best advantage of those classroom teachers who have taken the initiative to integrate technology and computer tools into their curriculum. In addition, preservice and inservice teachers have the opportunity to talk with these classroom teachers to discuss the problems and issues that will inevitably arise with such integration efforts. The criteria for selecting the "best practices schools" was in large measure developed with the Advisory Committee and address such critical issues as assessment and the articulation of goals and objectives that support the new curriculum standards. We were also particularly interested in including those teachers who have moved forwarded and integrated open-ended learning environment types of tools, such as multimedia development, webpage design to support research, and the incorporation of multiple electronic sources to support research.

Bronx Superintendents' Technology Leadership Forum

Approximately two years ago, the Technology Coordinators' Advisory Committee requested that the Division sponsor a series of forums to support our local superintendents to develop long range technology plans. Beginning Spring term, 1999, their request will become a reality as a result of much planning and with funds provided by NetTech. The six community school district superintendents and the high school superintendent will form leadership committees, which they will actively chair, and will attend a series of workshops to become better informed about the several components that comprise a long range technology plan. After a period of preparation, the superintendent leadership teams will meet in a number of workshops with their respective principals to guide them through the same planning process. The major technology players in NY State, NY City, and the NetTech region will be invited to answer and address the questions of the superintendents and their principals. As a result of these workshops and meetings, our Division will be better able to also plan how we can collaborate and partner with the school districts to effectively integrate technology and computer tools into the curriculum to support student learning and to better prepare future teachers.

Conclusion

The tasks we have outlined for ourselves will continue to be assessed and developed as we proceed with our plan, which is, of course, always evolving. Many problems have arisen, a few have been solved, and others will continue to rise up. However, our aim is to always search for solutions and to continue to engage in thoughtful and reflective collaboration.

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Avoiding Pratfalls in K-16 Collaboratives

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Abstract: Technocentric collaboratives pose unique challenges to university faculty. Recommendations from prior research in the areas of technological innovation, teacher development, teacher acceptance of technology, implementation of change processes, and professional development can provide valuable insights for university faculty while informing the planning and implementation of technocentric collaboratives with K-12 schools.

Introduction

The call for collaboration between universities and K-12 schools comes from sources ranging from state legislatures to local school districts to regional colleges of education. Increasingly, universities are working towards fulfillment of the vision of the Holmes Report (1995) to form "not just a working coalition of schools and universities as they are, but a powerful synthesis of knowledge to help us find out what the schools of tomorrow might be like." Many proposed collaboratives center on the use of computer technology in schools as local districts find themselves inundated with new hardware and scrambling to provide teachers with meaningful education on the use and integration of computers in the curriculum. No matter how innovative and creative the vision for the collaborative venture, the reality of creating working and viable technocentric collaboratives between institutions of learning whose traditional organizational patterns champion closed doors and individual initiative is often more difficult than originally envisioned. Existing research can inform the planning and implementation of any technocentric K-16 collaborative.

An Overlay of Continuums

Embedded within the culture of schools are individual teachers who could theoretically be placed on three continuums: acceptance of technological innovations, teacher development, and acceptance of computer technologies. The overlay of these continuums illustrates the complexity of the system in which the collaborative will be placed.

Continuum of Technological Innovation

Three stages can be observed as technological innovations move from potential to fulfillment (Naisbitt 1982). In the first stage, the technology is introduced in ways that are non-threatening. In schools this level was observed when Apple II-e's, sitting in the back of the classroom, were widely used as classroom behavior reinforcement props or free-time activities.

Second stage technological innovation occurs when the new technology becomes increasingly merged with older technologies. At this stage, the new technology performs existing tasks more efficiently than older technologies. In education, teachers use electronic gradebooks, professors convert overhead transparencies to PowerPoint presentations, both students and teachers use the computer as a typewriter, and students become facile with skill and drill software aimed at mastery of discrete skills.

As people become accepting of a new technology and recognize its place in their present lives, a third stage of innovation emerges. At this stage, the innovation itself begins to drive practice in different directions while opening the door to new applications and further innovation.

Educational use of computers in today's schools illustrates acceptance at the second stage level of innovation. However, as school districts across the country are discovering, this is not exclusively the result of low levels of hardware availability in classrooms. Indeed massive infusions of hardware may impede the use of computers rather than nourish their use. The answer to this curious contradiction may lie within additional continuums that must also be considered.

Continuum of Teacher Development

A variety of researchers have provided descriptions of the various stages of teacher development. Whether their descriptors utilize a three stage or four stage developmental scale, all point to varying needs of in-service teachers at each stage. Each illuminates the vastly different behaviors and methodologies of teachers along their respective continuum. One teacher development scale sets forth a four-stage pattern of development with the following stage descriptors: becoming, growing, maturing, and the fully functioning professional (Gregorc 1973).

The *becoming* stage teacher was identified as just beginning to develop initial ideas about the nature of teaching, role expectations, and the role of school as a social organization. They felt that their role as a teacher was to impart knowledge to students, get through the book, and do what the principal said. In a technocentric collaborative venture, these teachers, while exhibiting great enthusiasm for technological innovations, may become frustrated at how to implement these innovations in light of the perceived need to make it through the book. Likewise, they are easily influenced by other educators at the school site and their preconceived perceptions of technology in the classroom.

As teachers moved into the *growing* stage, their concepts and stereotypes of their roles and school continued to develop but in the light of more personal knowledge and familiarity with curricula, students, materials, equipment, and their own strengths and weaknesses. Gregorc also found that some teachers made it to only this stage, stopped developing, and rejected new experiences. The group of teachers at this level, whether entrenched or merely stopping by, can provide the greatest amount of challenge in any K-16 collaborative. Having successfully completed the becoming stage, educators in the growing stage have developed a sphere of comfort and any intrusion into that sphere may be viewed with suspicion and skepticism. From this group of teachers may also come the fear of technology as one more subject to teach.

The *maturing* stage found teachers who were characterized by a strong sense of commitment to education, participation in the greater school community, and service as educational resources to fellow faculty. Earlier stereotypes were reexamined leading to new insights about education, students, and themselves. Teachers at this stage, should they personally embrace the value of integrating technology into their curriculum, will move rapidly in allowing students to serve as leaders in absence of the teacher's personal expertise and allow technology to serve as another valuable tool in their curricula. These educators will most often be willing to share their experiences with fellow staff members. How other faculty members receive their efforts will be independently determined by each teacher's place on the development continuum.

Finally, teachers at the fully functioning professional stage have made a full commitment to education while trying to realize their full potential both as individual teachers and as part of the larger profession. New concepts are tested and belief restructured in a continual spiraling growth pattern. Such teachers may find that technology will fundamentally change the way they teach, moving more towards project-based curriculum, collaboration with other faculty, encouragement of student cooperative groups, and educational inventiveness.

Regardless of where an educator exists on the developmental scale, the introduction of computer technology can challenge current belief systems, pedagogical patterns, and their patience. Attention must be paid to their self-concept as learners. Their acquisition of the skills needed for personal use of the computer and the ability to successfully integrate the computer into their classroom curriculum will place them on yet another continuum.

Continuum of Teacher Acceptance of Computer Technology

Teachers immersed in a technology rich environment move through distinct stages of use and application. A four-stage process of growth has been identified (Dwyer, et al. 1990). In the *adoption* phase, educators were involved in learning how to use the technology themselves and were concerned with how to make it work with their traditional curriculum and method of instruction. Most often they turned to

CAI software for drill and practice of basic skills. Minor technical glitches in both software and hardware were initially viewed as insurmountable obstacles. As much support was needed for these technical glitches as was needed for simple skills development. Classroom computers were turned on only occasionally and the computer lab was frequently void of students.

The *adaptation* phase found teachers discovering that they could cover their usual curriculum faster with technology and that left more time for experimenting with restructuring ideas such as problem-centered curriculum. Curricula were modified to take advantage of time opened up by increased productivity. Skills the teachers had worked hard in mastering for their personal use in the adoption stage such as basic desktop publishing began to be presented to students and encouraged in use by students. Labtime became a precious commodity, resulting in scheduling conflicts.

Entering the *appropriation* stage, the majority of teachers began experiencing a fundamental shift in their view of teaching. Technology became integrated into more innovative approaches such as team teaching, team curriculum development, student collaboration, and interdisciplinary projects. Team teaching was explored, as was flexible scheduling at the secondary level. The demand for instruction in more complex technology issues increased. Web publishing emerged as a collaborative venture for faculty. Advanced applications such as PhotoShop were employed as were digital cameras and scanners. Greater interest in mastery of multimedia software emerged. Teachers found increased need for computers in the classroom as they began to facilitate student cooperative groups.

The final stage or *invention* phase of the study found teachers building new learning environments that employed technology as a flexible learning tool. They came to view learning as a creative and interactive process. Knowledge became something learners needed to construct for themselves rather than receive from someone else. Alternative forms of assessment were integrated and a balanced, strategic use of direct teaching and project-based teaching was developed. Computers in classrooms were turned on from the beginning of the day and used frequently by students throughout the day. Lab time evolved to a more refined usage, primarily used as an opportunity to complete projects begun in the classrooms.

The convergence of these three continuums – technological innovation, teacher development, and teacher acceptance of computer technology – occurs uniquely in each educator at each level in each school. The vision of this complexity can inform the planning of any K-16 technocentric collaborative for it points to the need for flexibility in planning and implementation to satisfy the needs of individual teachers. It can also serve to illuminate behaviors encountered as the collaborative proceeds.

The introduction of computer technology and the consideration of its infusion into a curriculum represents a significant change process. After reflection on the complexity of the individuals being served by any collaborative, factors of implementing change should be considered.

Implementation of Change Processes

Consideration of the myriad of possibilities afforded by an overlay of the above three continuums illustrates that the plan of any technocentric project can appear deceivingly simple if it fails to consider the complexities of initiating change in the school environment. This complexity is well described in 3 tiers of interactive factors in the implementation of any change process (Fullan 1991). The first two of these three tiers - characteristics of change and local characteristics - may inform the implementation of any collaborative.

Fullan's first tier stresses the characteristics of change and consists of four items: need, clarity, complexity and quality. It seems obvious to note that early in the implementation stage of any project, the people involved must agree that the *needs* being addressed are significant. However, while this may have been accomplished in the planning of the project, the larger group of participants must buy into the significance of the need as well. In complex projects, all needs may not be apparent early in the project period. Participants must be involved in hands-on projects immediately so that emerging needs may be identified and stated.

Clarity about the goals and means of any project presents a continuing problem. Complex innovations in a human environment highly dependent on teacher continuums increase obscurity of goals. Teachers are likely to be unable to state the vision and focus of a technocentric change at their school and may be frustrated by not knowing what change in behavior is expected of them. Revisiting the goals of the project often can be beneficial but changes in the means for achieving those goals must be approached with caution. Too much fluidity can give the impression of lack of concrete planning and may ultimately cause K-12 faculty to question the competency of both their administration and the university partners.

Complexity of change deals with the extent of change required of the participants in the project. It is compounded by each participant starting from differing positions on each of the continuums as well as the complex interactions between required skill levels and internal conflicts with existing belief systems, pedagogy, and materials. Technocentric projects are extraordinarily complex, requiring teachers to develop new skills, examine existing beliefs, and adjust current methodology.

Finally, the *quality* of the innovation must come under close scrutiny as it underscores the subtle interplay of need, clarity, and complexity. While the need for the innovation may be obvious, the quality of the program must not be taken for granted. Any project being brought to an educational institution must pass the "practicality ethic" (Doyle & Ponder 1977-78). Changes perceived as practical by educators will address observable needs, fit well with the teaching environment, be logical in implementation, and let educators walk away with concrete applications adaptable to their classrooms and teaching styles. The project also must be structured such that tangible successes are observable by the participants early in the implementation period (Huberman & Miles 1984).

The second tier of interactive change factors deal with local factors: school district, board and community characteristics, principal, and teachers. One significant precondition to the success of any collaborative is the track record of the *school district* in not only encouraging innovation but also supporting it through financial and philosophical means. While staff at a local school may be able to successfully implement a technocentric project, that project will not be replicable at other sites without top down support from the district administration. Central administration must demonstrate through actions that they will support innovation for teachers learn quickly which innovations to pay attention to and which to discount as a passing fad.

Board and community characteristics may seem at a level beyond which to consider as an implementation factor but support from both the board and the community of the local school are critical in the continuation of the innovation after the implementation phase. Involving parents and local businesses from the start provide an outer level of support for the project. The wisdom of building in exit experiences in the project that provide a showcase for board members is politically astute.

Of more obvious value to successful implementation of a technocentric project is the support of the *principal* and the *teachers*. Ultimately whether the innovation is accepted or blocked lies within the purview of the principal and the teachers. While it could be assumed that their support was part and parcel of the planning stage of the project, one must continue to plan for their support during the implementation as well. It cannot be taken for granted.

Principals must be viewed as partners in the grant implementation. Ideally, principals should act as instructional leaders and care should be taken to facilitate and encourage them in that role. When teachers see and feel the active support of their principal in any change, through psychological support, material support, and active participation in workshops, projects stand the greatest chance of success.

Obviously, teachers play a significant role in the implementation process. When teachers who are at the maturing and fully functioning professional points on Gregorc's scale approach innovation, they do so in a self-actualizing manner with a greater sense of efficacy than do those teachers at the first two points of the scale. Likewise, relationships among teachers are of vital concern for the researcher. Schools that have a high number of change-oriented teachers who have had the opportunity to establish a learning community, albeit informally, provide a psychologically safe environment in which to experiment and learn as a professional. A technocentric project ideally involves learning to do something new and interaction is the basis for social learning. If opportunities for communal discussions do not currently exist, then the project must be structured to provide that time in a facilitated manner. Judith Little (1981) distinguished this type of social learning as, "Teachers engage in frequent, continuous and increasingly concrete and precise talk about teaching practice (as distinct from teacher characteristics and failings, the social lives of teachers, the foibles and failures of students and their families, and the unfortunate demands of society on the school). By such talk, teachers build up a shared language adequate to the complexity of teaching, capable of distinguishing one practice and its virtue from another."

Professional Development of Educators

Technocentric collaborations must not only address sound teacher development principles but also the need for technological support of emerging learners. Needs may emerge that extend beyond the original vision of the collaborative. Whatever the needs being addressed, key elements of successful in-service teacher development programs must be addressed consistently throughout the implementation

process. Loucks-Horsely and colleagues (1987) have identified ten characteristics of successful teacher development. These characteristics are listed below along with some applications of each in technocentric collaboratives.

Characteristics of Successful Teacher Development	Application to Technocentric Collaboratives
1. Collegiality and collaboration	Respect of teacher expertise and experience; gradually move towards collaboration (it's not native to the teacher culture)
2. Experimentation and risk taking	Create a safe environment by providing ample support for learners at a variety of levels
3. Incorporation of available knowledge bases	Teachers know where their strengths lie as an educator – allow flexibility so that they can start from that strength
4. Appropriate participant involvement in goal setting' implementation, evaluation, and decision making	Build in means for obtaining feedback from all participants throughout these steps
5. Time to work on staff development and assimilate new learning	Respect teachers' time; build in funds for release time; be prepared to provide in-class support and modeling of new processes
6. Leadership and sustained administrative support	Seek to have principal participate in large group activities; nourish emerging leadership among staff; use jigsaw method to create experts
7. Appropriate incentives and rewards	Make efforts to assure success at every stage; be creative in arranging time for teachers to collaborate
8. Designs built on principles of adult learning and the change process	Remember the test of practicality; recognize the unique needs of the adult learner
9. Integration of individual goals with school and district goals	Reflect on the continuums presented above and how those inform individual goals and the support structure for those goals
10. Formal placement of the program within the philosophy and organizational structure of the school and district	Find the ways technology can support the unique programs of the school; consider what will happen when the collaboration ceases as an active agent.

Particular emphasis should be placed on the eighth characteristic, "...built on principles of adult learning and the change process." While the change process was discuss in the preceding section, research from the field of adult learning lends credence to the ability to develop on-site collaboratives that would allow teachers to integrate new information into their existing stage of development. Wood and Thompson (1980) support programs that include experiential learning and informal learning situations in the context of social interaction among participants. The following components comprise such a learning experience:

1. A brief orientation that is followed by participation in a variety of experiences embedded within a real situation. This allows learners to experience and implement the skill, concept or strategy being presented.
2. Reflection on the experience: what was learned, how this can be applied to their particular setting, analysis of the way the experience was presented and extension into the workplace.
3. Opportunity for participants to generalize and summarize this reflection, to provide closure to the situation, and to vocalize principles attained.
4. Opportunity to return to work site to try out new knowledge, principles and to develop confidence in what was learned and its real application.

When applied to a school setting, these four components can be applied within project-centered in-service segments of a collaborative. Teachers are presented with a brief orientation to the innovation at hand and then given an authentic project to complete in cooperative groups. At the end of the session,

teachers return to the large group to share their products and the facilitator leads a bridge-to-practice closure session that promotes reflection on the experience and extensions to the classroom. Teachers can then return to the classroom in the interim between sessions to find applications for what was presented. At the start of the next session, teachers share successes and examples of how they applied the knowledge in their classrooms. This iterative process of evaluation encourages experimentation with the innovation, bridging the innovation to current practice, feedback on the implementation of the innovation, and subsequent modification of methodology in a continual spiral of growth and evaluation throughout the period of collaboration.

Conclusion

Collaborations between K-12 schools and universities offer tremendous potential for mutual enrichment. Collaborations that focus on computer technology and its integration into the classroom offer unique challenges. A number of factors must be considered prior to and during the planning and implementation stages of the collaborative. The continuums of technological innovations, teacher development, and teacher acceptance of computer technology can be overlaid to give a multidimensional view of the complexities of the demands that will placed on the collaborative. The facets of initiating change in a school environment must be considered before hand and continually revisited throughout the implementation period. Finally, each presentation of the collaborative needs to be planned in light of research on successful professional development for educators and the respect for their unique needs as adult learners. Consideration of these three areas may diminish the opportunities for university faculty to take pratfalls in their collaborative ventures with K-12 schools.

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A HEURISTIC EXAMINATION OF INSTRUCTIONAL TECHNOLOGY IN A TECHNOLOGY-INTENSIVE LEARNING ENVIRONMENT

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Abstract: In 1993, the faculty, students, and administrators of Wake Forest University began to develop an outline for what was to become *The Plan for the Class of 2000*. The University implemented this ambitious strategic initiative aimed at enriching the educational experience of all undergraduate students in the fall of 1996. This initiative embodies the widespread implementation of information technology both inside and outside the classroom. While the technology infrastructure largely is in place, work remains to infuse the use of technology in the educational process. Significant resources are required from all stakeholders in the University to further the development of innovative applications of technology in the classroom. Further examination of every discipline within the University has uncovered creative uses for technology in the instructional process.

INTRODUCTION

Wake Forest University, founded in 1834 by the Baptist State Convention of North Carolina, is characterized by its commitment to a liberal arts education, a strong sense of community and fellowship, its encouragement of freedom of expression and inquiry, and the pursuit of excellence in undergraduate and professional education. The University has made a conscious choice to remain small. In 1993, the faculty, students and administration of Wake Forest University began developing an outline for what was to become *The Plan for the Class of 2000* (hereafter, the Plan). The goal of the Plan is to enrich further the University's

undergraduate education through seminars for first year students, an increase in the number of faculty and information technology support staff, a decrease in class size, additional scholarship funds and financial aid, and finally, the issuance of IBM ThinkPad computers to all first year students (Fyten, 1995). In the fall of 1996, Wake Forest University implemented, upon consensus by the faculty, this ambitious initiative aimed at enriching the educational experience of all students. The Plan has as its centerpiece the widespread implementation of information technology both inside and outside the classroom. Implementation of the Plan has resulted in significant amounts of time and resources being expended on technology initiatives by the faulty as well as the University.

While the ubiquitous presence of computer technology in academe has led to the increased use of computer-enhanced instruction in the classroom, faculty members are raising many interesting and important issues across the country. Wake Forest University is no exception. As institutions of higher learning expand deployment of information technology toward the betterment of the learning process, there is a need to determine where instructional technologies fit in the higher education curriculum. Educators must have the ability to discern those activities that might truly be enhanced by the use of technology, identify educational opportunities that may or may not exist without the use of such technologies and align its use with learning opportunities in the undergraduate classroom. As expected, some faculty have embraced the use of instructional technology in the curriculum. Others have taken a "wait and see" attitude or simply languished in the uncertainty of whether or how to use technology toward the betterment of the learning experience. While the technology infrastructure largely is in place, much work remains to infuse the use of technology in the educational process. Significant resources are required from all stakeholders in the University to further the development of innovative applications of information technology in the classroom. The purpose of this study was to examine the use of computer technology and issues surrounding its use, inside and outside of the classroom at one university.

METHODOLOGY

This study examined instructional technology activities within the undergraduate courses of Wake Forest University. Subjects for this study included faculty members at the University. Data was obtained through interviews performed by the Academic Computing Specialist (ACS) for each department. As a part of the technological infrastructure, each department of the University has an ACS charged with assisting faculty in the implementation of computer technology in the curriculum. The data is valid because the ACS works closely with faculty members within the particular department and is very knowledgeable about the implementation of computer technology. Each ACS reported the number of faculty within the department who used technology frequently (greater than 75% of the time) or occasionally (at least 25% to 75% of the time), or seldom (less than 25% of the time) or never for each category in the survey. Data were collected for all full-time faculty members (n=369) within the University. Data was also obtained by interviewing faculty that teach in a variety of disciplines such as religion, English, and physics. These interviews were conducted by three of the authors.

FINDINGS

Faculty members who consider taking on the task of using instructional technology in the classroom must be willing to revisit their own pedagogy. A tremendous amount of time is required of the educator who reexamines the curriculum and looks for ways to enhance the learning experience of his/her students. Currently, some faculty members are spending an inordinate amount of time and energy on the integration of technology in the curriculum. As the administrators of the University encourage faculty to embrace technology, faculty members face the issues of time constraints as well as the uncertainty of whether or not such instructional technologies will add real value to the learning environment. The best cognitive theory that corresponds with the use of such instructional technology in the classroom is constructivism (Chu, 1997).

Constructivist teaching involves learning activities that are more student-centered versus teacher-centered. The hands-on nature of this new learning environment calls into question the more traditional role of the educator.

The role of the educator is changing as a result of bringing technology into the classroom. Some faculty members have expressed that technology has added to their effectiveness as a facilitator of learning. Technology has allowed faculty to maintain better contact and communications with students. Faculty, in a variety of disciplines, are using the resources provided by the University to develop many innovative and timely uses for instructional technology in the higher education curriculum. As a result of the use of technology in the classroom, faculty members noted that students tend to check email more frequently and the course Web site for reading material. Faculty also indicated that students tend to show an increased interest in staying abreast of events in the course. This has led to better discussions on-line as well as in class and has allowed the opportunity to enhance the learning process. The increased use of e-mail inside and outside of the classroom is evidenced (see Figure 1). Representation of total e-mail use for the undergraduate campus at Wake Forest University is provided.

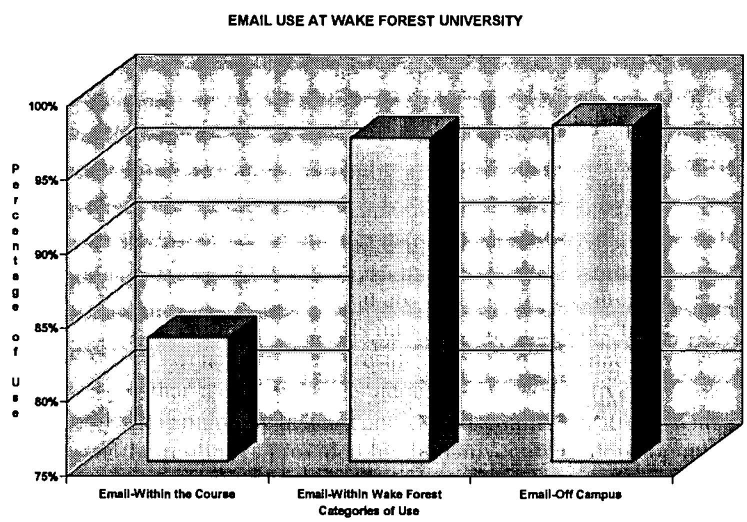

Figure 1: E-mail use by full-time faculty

The use of technology tools such as word processing, spreadsheet, and presentation software is prevalent at the University (see Figure 2). The chart below indicates the use of software/technology as a technology tool at the University.

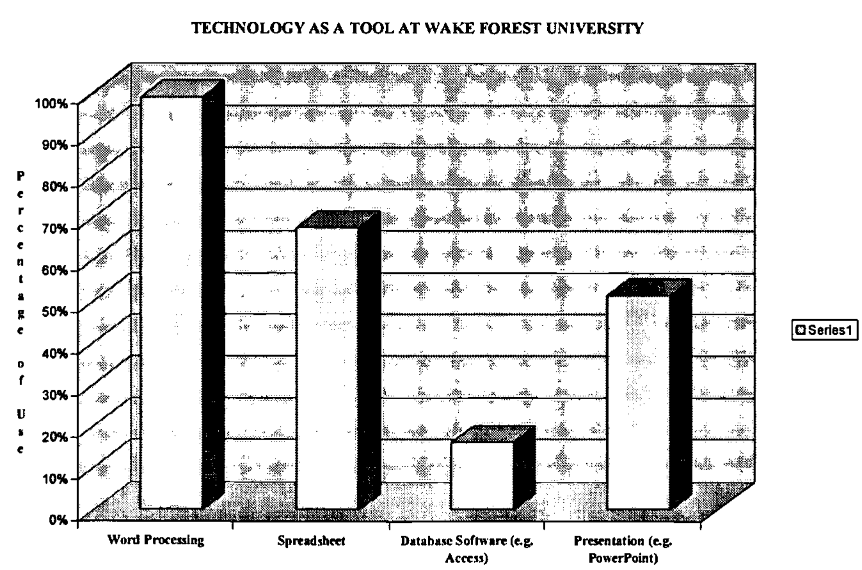

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Figure 2: Use of software by full-time faculty

Faculties resist the implementation of instructional technologies into their courses for a number of reasons. Rosener (1997) found that reasons for not using the computer included the lack of a reward system in faculty evaluation structures, lack of equipment, software and technical support, and lack of compelling reasons to change. Another study (Matthew, et al., 1998) found that faculty concerns about adoption of technology were fear of change, fear of time commitment, and fear of appearing incompetent. Faculty at Wake Forest University echoed these same concerns.

One Wake Forest faculty member felt that any model of learning could be adapted through the use of technology if consideration is given to the course content, its appropriate use, and the enhancement of the overall learning experience. It was also mentioned that while technology might provide a more attractive lecture, it doesn't mean that it is more effective than the traditional model of delivery. Faculty expressed a positive attitude towards using the technology at times, because it allows for a more interesting class. For example, students can view a slideshow with pictures and sound that provide an opportunity to view the lesson as well as hear the lesson being taught. This proves to be more engaging than relying upon the traditional methods of delivery. Another faculty member expressed concern with the ever-changing nature of technology, citing time constraints and the discouragement of "starting over" as a major inhibitor to adopting technology.

Accommodating the various learning styles and giving consideration to how students process information differently presents additional issues. A faculty member further noted that race, gender, and technological literacy must also be addressed. Given the differences in learning styles, the faculty member provides a grading scale that allows students to weight projects and assignments in such a way as to take advantage of their own strengths. So, if a student feels comfortable putting more weight on an assignment that requires more traditional methods of delivery versus an assignment that requires greater use of technology, the student may do so without penalty. In addition to traditional teaching methods, the Wake Forest faculty employ a variety of electronic resources. Graphical representation of electronic resources used by faculty as instructional tools are provided (see Figure 3).

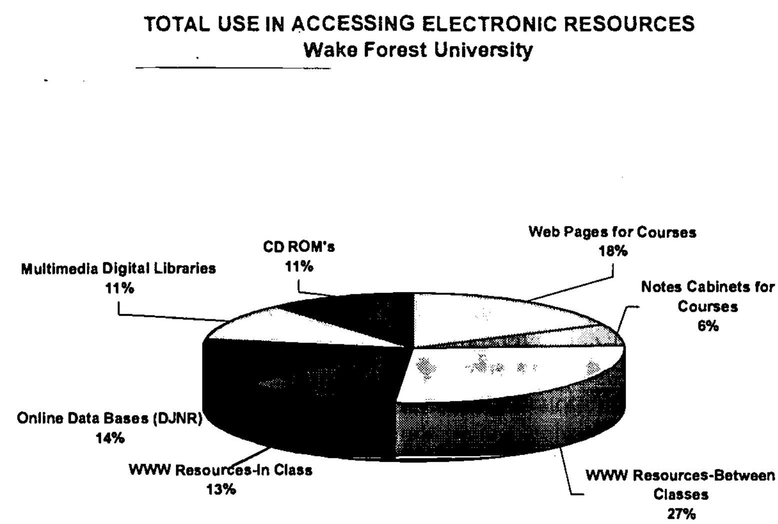

Figure 3: Use of electronic resources

CONCLUSIONS

Of paramount importance to faculty members are the quality of instruction and maintaining that quality as a result of the integration of technology in the curriculum. "New ideas from cognitive science propose the importance of 'anchoring instruction' in activities that students find meaningful and 'authentic' in the context of their own experiences" (Roblyer, et al., 1997). While there is no evidence to prove that instructional technology has a greater impact on the learning experience in comparison to more traditional methods of delivery, there is

no evidence to disprove the enhancement of learning in a technology-intensive environment. As institutions of higher learning expand deployment of information technology toward the betterment of the learning process, there looms the significant task of creating an organizational move toward the acceptance of IT as an integral and valued part of the University's culture. Inclusion of technology initiatives in the overall culture will validate the significance of IT innovations in the teaching and learning process and evidence that this work is valued and will be rewarded.

As technology has evolved over the years, an important issue has surfaced within the halls of academe. How can constituencies remain attentive to the overarching intent of instructional technology's use in the higher education curriculum and maintain an effective balance to facilitate learning and inquiry among their students? "In education, the combination of process and product merges instructional procedures with instructional tools...Guidance in the application of tools comes from learning theories based on the science of human behavior" (Roblyer, et al., 1997, p. 8). Can one truly exist without the other?

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Steps Toward Success: Technology Integration Into a Teacher Education Program

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Abstract: In order to integrate technology into the preparation of teachers, systematic change must occur. This project which includes addresses preservice faculty and student needs. Higher education faculty are,provided professional development aimed at increasing technology use for instruction and for student performance expectations. Preservice students are involved in the development and demonstration of competencies to meet ISTE Foundation Standards for those seeking initial certification.

Introduction

In 1995 the OTA study, *Teachers and Technology: Making the Connection,* was critical of the preparation of new teachers in the uses of technology in teaching. The researchers in that study found that technology use was not central in the preparation experiences in most colleges of education. As a result, most new teachers are ill-prepared to integrate technology-based experiences into their professional practice. Thorsen and Barr (1997) report a significant challenge is the identification of technology "need-to-know" or identifying the skills and knowledge teachers need and how to test and verify that knowledge. This is not a surprising nor is it a new observation about the use of technology in teacher education programs. We believe it is safe to say that many, if not most, teacher education programs fall far short of what needs to be done to prepare new teachers for the classroom environments in which they will be working. A variety of efforts have been put forth toward helping students become better prepared technology users. Often these efforts are built on what has become known as 'the required computer course'.

The authors believe it will take far greater efforts to make institutionalized change occur in the preparation of preservice teachers. This change must occur as a systematic process within the environment in which the future teachers are prepared. All the stakeholders need to be prepared to move the plan forward; there must be administrative support, education faculty need to be assisted as they reconsider the teaching strategies and materials they use to present the content to students, supervisors and cooperating teachers must be made aware of the expectations for the preservice students with whom they are working and these students need to understand the technology competencies to be mastered during their preparation as teachers. It is important that all of those involved in the program have a vision of what is to be accomplished and specify ways in which technology-based experiences will support that vision (NCATE, 1997).

Need To Move Integration Implementation Forward

The numbers of computers in P12 schools increase every year. Expectations that practitioners will be able to incorporate technology use into the classroom and enhance learning environments are widespread. A current concern is the lack of preparation of preservice teacher candidates to use technology in their teaching. Changes in two professional organizations have had an impact on integration efforts. The ISTE Foundation Standards were first introduced in 1992 and revised in 1995 (Wiebe & Taylor, 1997). These provide a set of competencies that all new preservice graduates should achieve. The National Council for Accreditation of Teacher Education (NCATE) also revised their precondition standards to call for a greater emphasis on technology use. In 1995 NCATE modified its general unit guidelines to require that all teacher education candidates complete a "well-planned sequence of courses and/or experiences" that help develop understanding and use of computers and related technologies for teaching and learning (Thomas, 1995, p.

5; Also see http://www.iste.org/specproj/standards/unit.htm). For many colleges seeking NCATE accreditation, the ISTE Foundation Standards provide a framework for addressing the new technology-related unit guidelines.

Our prior work with the model suggests that a critical first step in implementing technology integration into preservice programs is obtaining the commitment of faculty involved in those programs. Faculty have always enjoyed great autonomy and, in addition, each faculty member has differing levels of comfort with the technology and interest in using it (Horgan, 1998). A key ingredient in helping faculty through this process is to blend learning the use of specific technology tools with an understanding of how it can improve teaching and learning. Professional development opportunities are needed for existing faculty to learn about the technology itself and then learn how to integrate relevant experiences into their teaching plans (U. S. Congress, 1995).

Students, too, are demanding technology experiences. They know they will be expected to use a variety of technologies in their work as teachers. In addition, few have had any experiences seeing technology modeled by their teachers during their school experiences. It is critical that faculty move toward integrating technology into their teaching so students have opportunities to acquire knowledge through observation. Lortie (1975) told us that teachers teach as they were taught. They need to move from learning in the lecture method to learning in an engaged learning environment that allows them to construct knowledge (Gunter & Lee, 1997). This college experience may be the only time that these students see technology use modeled and valued by an instructor.

How, then, can colleges of education help their faculty to revise and revision their approach in content area courses and make best practice use of technology tools available to them? What kind of assistance needs to be provided to education faculty to make this complex transition in their own teaching?

A Systematic Model

First Efforts

Handler and Strudler (1996) proposed a model based on the ISTE Foundation Standards. This model provides a framework through which faculty select the appropriate technology-based experiences for their courses and indicate the ISTE Standard to be met through these experiences. Many colleges of education have a required introductory educational computing course. This model assumes of the existence of a course in which students are introduced to the concepts and tools referred to in the standards. After students complete that course, faculty may expect that students possess certain basic skills and knowledge. Thus, in content area courses, instructors will not need to teach *about* the technology but will provide experiences to help students teach *with* the technology.

Implementation of the model should provide the full range of experiences required to meet the Foundation Standards while not putting an excessive burden on any one department or faculty member. The first step in the model has faculty working with a matrix showing the ISTE Foundation Standards on one axis and the courses in the preservice program on the other. Faculty identify the particular standards that can be reasonably met within their particular courses. This distributes the responsibility across all areas of the program. The second step is to identify the family of software that will be used to meet the goals. That is, they choose between presentation software, word processing, hypermedia, telecommunications tools and other generic areas. Lastly, specific activities are designed along with methods of assessment for the content and the technology skill. The model was piloted by Handler and Strudler at their respective institutions (National-Louis University and University of Nevada Las Vegas) and needed areas of additional support emerged from that effort (Strudler, Handler, & Falba, 1998).

Next Steps

At this time the University of Nevada Las Vegas does not have a formal effort in place to further implement the model. Serving the fastest school district in the country, UNLV has been confronted with the challenge of dramatically increasing its output of teacher education graduates. Under great political

pressure to meet this need systematic efforts in technology integration has not been a primary priority in the college of late. Current support efforts include working with individual faculty and interest groups.

National-Louis University however has made a commitment to support further implementation of the model and take a more systematic approach. National-Louis University (NLU) is able to take a more systematic approach. One of the key issues that emerged from earlier efforts is the awareness of the very broad continuum on which faculty members' technology skills lie. Some are very interested in technology use and are active personal users but have very little awareness of the materials available to meet their instructional or content area needs. Others are those faculty who rarely, if ever, touched a computer. Many faculty themselves do not yet have the skills identified in the ISTE Foundation Standards for beginning teachers. As we know from work with classroom practitioners, knowing 'how to use' the software does not mean a knowing of 'how to integrate these tools into a lesson'. This is also true of higher education faculty.

This paper delineates effort to move the model forward at National-Louis University while addressing issues raised as a result of the first efforts described by Strudler, Handler and Falba (1998). These include the need for strong administrative leadership, support for faculty as technology use is integrated into their own teaching, and access to resources. Work with faculty during this project will encourage the development of opportunities for students to recognize and demonstrate their own competency.

National-Louis University

Several factors influenced the timing for this NLU commitment. We are under the leadership of a new president and the technology infrastructure is receiving more attention than it has in the recent past. The National College of Education is in the midst of preparation for NCATE approval. The dean is highly supportive of processes that will assist the integration of needed technology experiences into our preservice programs. A considerablee portion of Handler's teaching load was assigned to to this effort. This use of faculty as resource is one important indication of the administrative support.

This integration effort has several strands developing concurrently. The first or faculty strand will address the need for development of faculty technology competencies, the infusion of technology experiences into their own teaching and their learning to work with the Technology Competency Database (TCD). This database will be more fully described later in the paper. The second or student strand is structured to document their mastery of the ISTE Foundation Standards. These strands are linked through course presentations, assignments, and activities that provide opportunities for students to apply the technology skills they are learning.

The Faculty Strand

The first full-day teacher education faculty retreat was held in November, 1998. The goal of the day was to involve more college faculty in moving the integration process forward. The coordinator of the elementary education programs and of the technology in education program designed the retreat agenda. Thirty faculty members were invited to participate; two from each of the courses offered in the elementary preservice program. Many participants were confident as personal technology users. Some were already providing technology experience within their courses. Others were willing and interested but unsure of themselves in the area of technology use. Invitations to participate were issued from the dean and responses were collected through her office. A Friday was selected as most faculty were available on that day. The second notices, also sent out by the dean, indicated meeting place, included an agenda and requested each participant to bring a copy of a recent syllabus. To brighten the day a continental breakfast and lunch were included.

A three-ring binder was developed for use during the day. This type of binder was chosen to encourage a 'we will be adding more as we go' way of thinking about the process. Sections of the notebook included all standards and forms, master course outlines and syllabi, articles on tools supporting student activities, faculty support materials, printouts from the Technology Competency Database (TCD) and a variety of

professional readings. The last item in the notebook was a form that could be copied and sent to Handler for additional support at any time.

After reviewing earlier efforts related to the model, the revised ISTE Foundation Standards were introduced along with a group introduction to the Handler/Strudler model. Based on courses taught, faculty were assigned to small groups. Their task was to match ISTE Foundation Standards to existing master course outlines and individual instructor syllabi while looking for student learning opportunities related to the standards. The model offers two possible choices in that task; that a standard will absolutely be met in all sections of that course or a standard might be met in that course. As expected not all of the standards were selected. They were entered into a matrix in order to identify overlaps and missing links. We are now placing the results on the computer and preparing to send out the list for its next round of selections.

A next step was for each group to consider technology-based lessons that could be woven into their syllabi as well as what teacher-led instructional experiences might look like. A second matrix listed the types of software that might be used in activities to address the selected standard. The categories (hypermedia, integrated packages, desktop publishing etc.) were listed with current example software (HyperStudio, ClarisWorks, Adobe PageMaker etc.).This list with its examples presented real difficulty and great discomfort for many participants. They were not familiar with some of the terms and many of the software titles. It was interesting to see how faculty members involved considered changing the standards identified once they had to think about creating the activities. It was a strong reminder of the necessity to move slowly through this process and of the great disparity along the continuum of faculty ability. This range of ability levels was also an issue in the earlier studies.

The third step of the day was to consider and create activities that would be appropriate for specific courses. Small groups used the activity forms provided to describe new and current practice that address the standards. Participants requested a database of all current activities be made available. There was great satisfaction within the group at the number of efforts already in place. During this time faculty also worked with the facilitators at the computer. They wanted to see several available programs which were unfamiliar and to visit particular web sites that had been demonstrated or described.

An important consideration emerged during this working time. It was sometimes necessary to help participants remember that technology was NOT the focus of the activity. The focus was the content or learning goal as always, but the road to that goal made use of a technology-based experience. There was a strong tendency to focus on what the technology DID rather than how the tool could HELP to meet the lesson objective.

An ongoing element was a shared discussion of major issues to be dealt with as part of program implementation. These included expected topics such as overlap of competencies in multiple courses and ethical and legal use of materials from the World Wide Web. Other issues, unique to our college, such as sessions for adjunct faculty and how faculty and adjuncts would work with the Technology Competency Database also emerged. Following the retreat faculty interest and efforts have continued to move forward. Faculty who teach an undergraduate foundations course have met specifically to think about how they can move forward in this area. In addition one of the facilitators is meeting with individual faculty members on presentation software and using the WWW in their courses.

The Student Strand

A pilot group of 65 preservice students were introduced to the competencies that the ISTE Foundation Standards have set as minimal requirements for all preservice graduates. The college of education plans to put this requirement in place for all graduates of elementary education programs. The Technology Competency Database (http://lrs.ed.uiuc.edu/tcd/), developed by Levin and Waugh at the University of Illinois, is the instrument that has been adapted for use in this pilot (http://192.217.49.150:591 /testdb/TCD.html). This instrument provides opportunity for students to identify ISTE competencies they have met and submit evidence demonstrating their competency in that standard. These entries are then

reviewed by faculty. There is discussion of extending the use of TCD into other initial certification programs.

All students in the pilot are graduate students in an elementary education initial certification program meeting in a cluster (or cohort) format. They were introduced to the database for the first time during their initial practicum experience in Fall98. Undergraduate students will begin to use the database during a required technology course Winter99. Opportunities for the development of competencies will be provided in class experiences throughout the program. Students will be encouraged to continually update TCD documentation as they develop greater knowledge of and comfort with appropriate software. Our goal is for the students to place evidence of their technology competencies in the portfolio that is a program requirement.

Conclusion

The success of such projects rests on faculty ownership of its importance for students and student acceptance of the value of these experiences. Ongoing administrative support will be required to maintain the level of assistance faculty will need for several years to come. At the end of this year we will collect data from the faculty to determine what additional support and efforts will be needed to truly institutionalize this integration process in our college. We will also collect information about the development of student competencies. These data will also help us to provide a model that will help other institutions in these same efforts.

As we continue our work this year one-to-one support is available to faculty as needed. They will be provided advice on how to continue the process and how to evaluate technology-based experiences in terms not of content but of meeting the competency requirements as well as opportunities to develop their own competencies. Several meetings of retreat participants will be held during the remainder of the year.

Continuing questions plague this particular endeavor. How will faculty be provided time to learn the various applications available to them? Will there continue to be administrative support of faculty in a consultative role? As faculty become more expert in utilizing technology in their teaching will resources be available for classroom use? Who will oversee new activities developed within each of the courses? Who will oversee that every faculty and adjunct are providing these experience to the students in their classes?

Additionally, much work still needs to be done in the area of the TCD. Administrative support for the web administration remains a programmatic need. How will sufficient access for all students be provided within the frame of current resources? For faculty there are other questions. Who will introduce the competencies to students and in what context will this be done? Who will accept or reject student submissions? Who will monitor overall progression for each individual student? How will the faculty become comfortable with the criteria for making judgments about student submissions? How can faculty expand opportunities for competence for both themselves and their students?

Endeavors such as ours exemplify opportunities for teacher educators. In this environment faculty can develop needed technology skills as well as learn to integrate appropriate technology experiences into their instructional settings. Through the use of the Technology Competency Database our work also encourages the development of these same skills among the preservice students.

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Integrated Technology Implemented in a Teacher Education Course on Diversity

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Abstract: America's educational system of the 21st century brings about new challenges for teachers. Integrating technology into the curriculum, developing and implementing effective teaching strategies, and responding to student learning styles are a few of the challenges. Until recently, preservice teacher education, schools, colleges, and departments of education were considered to be lagging behind in meeting the needs of developing technological competencies (Walters, 1992). Consequently, the course Diversity in Educational Settings was designed to emphasize six instructional goals and performance objectives. Throughout the course students engaged in several activities, that fostered the idea of integrating technology into class assignments. Cooperative groups were self-directed and managed. The course expectations challenged students to become creative and explore issues of diversity and technology. Students created materials for a particular audience from K-12. All materials promoted student's engagement, motivation, higher thinking skills, and assessment of their learning.

America's educational system of the 21st century brings about new challenges for teachers: integrating technology into the curriculum; effective teaching strategies, and responding to student learning styles. Until recently, preservice teacher education, schools, colleges, and departments of education (SCDEs) were considered to be lagging behind in meeting the needs of developing technological competencies (Walters, 1992).

Technology competencies challenges are divided into two major categories: 1) strengthening the capacity of SCDEs to prepare teachers to use instructional technologies and, 2) developing models and materials (Abdal-Haqq, 1997), as a part of the Teacher Education Programs across the country. Since 1995, the use of technology in classrooms demands technology training of teachers. Teacher Education Programs are responding to the recommendations of the National Council for Accreditation of Teacher Education (NCATE) implementing new unit standards which were recommended from the International Society for Technology in Education (ISTE) which ultimately challenges both teacher preparation programs and K-12 classrooms. These standards addressed content and pedagogical studies for strengthening the capacity of preparing teachers to use instructional technology.

Experiential/Action Learning

EDC 300 and 501 Diversity in Educational Settings are based upon a revision of the Experiential/Action Learning Model (Allen, 1996). This model promotes the infusion of technology while enhancing the students' knowledge and awareness of cultures. Both undergraduate and graduate teacher education students participate in team projects in which they use several multi-media technology to integrate into instructional strategies while learning about issues of diversity.

The model focuses on the learning process that combines concepts from observational learning (Bandura, 1986) and teaching and learning of skills and procedures (Allen, 1996; Beyer, 1987 & 1988). Bandura (1986) postulates four important elements to effective observational learning: 1) paying attention; 2) retaining information, 3) producing and reproducing behaviors, and 4) being motivated. Therefore, it is important for students to observe a behavior and have both the motivation and opportunity to reproduce the behavior (Allen, 1996). Students also need an opportunity to demonstrate an acquired skill through guided practice and receive direct and immediate feedback.

Experiential/Action Learning Model

Students learn best through active involvement. Their retention ability increases if they engage in the following sequence of steps: 1) observe demonstration of skill or usage of skill; 2) be given an opportunity to practice both in group and individually; 3) be given critical/specific feedback; and 4) re-define and/or refine skills and what they have learned before passing on or sharing information with others. Teachers must also become reflective of teaching strategies, learning styles and student assessment which promote effective change in the teaching and learning cycle. These changes suggest altering, enhancing, and developing effective approaches in order to educate students.

Application of the Experiential/Action Learning Model for EDC 300/501 Diversity Course

- Observation of the use of varied technology during class instruction
- Formation of heterogeneous teams
- Designed rationale for their choice of cultural investigation
- Team investigation into the culture with the objective being to gain awareness and understanding of the culture for the purpose of being better prepared to teach students of that culture
- Team work to develop a unit and resource manual of their selected culture. The use of technology was integrated into their presentation
- Created four interactive learning centers for multicultural fair with the use of technology
- Each team taught their unit, learning centers, and presented in the multicultural fair, demonstrating their skills integrating technology into presentation and demonstrating their understanding and awareness of diversity and discovering effective strategies for an inclusion classroom. (This model is adopted from Allen, 1996)

Technology

In EDC 300/501 Diversity course the context goal of technology and education, are focused upon five pedagogical competencies critical to the development of responsive, reflective, effective teaching of teachers: 1) engaging and motivating students in learning; 2) designing instructional experiences that integrate technology into the curriculum; 3) understanding and using technology to access, process and share information, 4) using technology to enhance higher order thinking skills; and 5) assessing student performance (O'Donnell Dooling, 1997). These five competencies can be transformed into classroom instructional goals for the purpose of providing opportunities for students to become technologically literate.

Course Instructional Goals

According to Pina, 1993, to use technology in support of student learning, regardless of access levels, preservice teachers must have sufficient understanding of and confidence in various technologies, assessing and using them effectively for instructional purposes. Consequently, the course Diversity in Educational Settings was designed to emphasize six performance objectives: 1) Understand and use technology to access, process and share information; 2) design instructional experiences that integrate technology into the curriculum; 3) learn to select instructional materials that are free of bias and stereotyping; 4) develop skills to help view other people as having equal worth and dignity regardless of their backgrounds; 5) learn problem-solving skills for effective communication; and 6) learn strategies that address learning styles of students.

Range of Technology Usage in the Class Presentation Project

Throughout the course, students engaged in several activities that fostered the idea of integrating technology into class assignments. Cooperative groups were self-directed and managed. The course expectations were shared with the students, which challenged students to become creative and explore issues of diversity and technology. Students were expected to create materials for a particular audience from K-12. All materials promoted student's engagement, motivation, higher thinking skills, and assessment of their learning. The groups ranged from high technology literacy to limited technology literacy.

A criterion list of activities and technological use was provided for the students. High tech groups integrated several types of technology usage throughout their class presentation. Three groups in particular demonstrated extremely sophisticated and effective usage of computer technology with their group presentation. These groups used PowerPoint, the internet, and web sites to involve the class in discovery of a country's macro-culture, language, art, music, location, educational, political and social systems, and many other facts regarding the country. One group also included an e-mail learning center between Cleveland State University and the International School in Cyro, Egypt. Students of the diversity class were able to engage in dialogue between teachers and classrooms in Egypt and those at the university site. Another group created a chatbox site between an elementary school in the Carribean Islands and themselves. A great deal of cultural exchange took place; students explored philosophies of education and implementation of instructional strategies. The third group connected with a missionary pastor from South Africa who was travelling to the United States and would be stationed with several Lutheran Churches in Ohio. The pastor was invited and accepted the invitation to speak at the university regarding the political, social and education systems of South Africa today. These groups demonstrated advanced technology skills and their ability to assign appropriate use with instructional goals.

The limited technology groups usage ranged from the usage of overhead transparencies to display boards. Most of the groups used overheads to emphasize important facts and information. There was a significant usage of videotapes to either show, explain or stimulate thought regarding a countryside, culture of the people or issues, art and drama and classrooms. Some groups developed videos to document their group experiences while participating in a field trip (i.e. restaurant, museum, city or street tour, church, temple, mosque) and/or an interview with a particular person or people. The class found these tapes to be most rewarding because it was similar to hands-on or self discovery. Audio equipment (tape recorders and CD-ROM) were used frequently. They were used to hear native language(s), national anthems, and different types of music (traditional and contemporary).

Conclusion

A wide range of abilities emerged (high technology literacy to limited technology literacy) from cooperative groups using the diversity paradigm definition to compile heterogeneous groups. A criterion list of activities and technological use was provided for the students. High technology literacy groups produced extremely creative materials with great emphasis on technology, while other groups created projects with the standard/traditional equipment that was most familiar to them. Some groups lacked a basic understanding of effective technology use in the classroom.

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TECHNOLOGY AND CHANGE IN EDUCATION: CULTURE IS THE KEY

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Abstract: The benefits of technology in education will not be fully realized without the focus on cultures that may potentially embrace them. Cultures encompass values, norms, and beliefs that normally protect these cultures from being significantly altered or destroyed. Leaders and stakeholders can create structures and collaborative environments to foster learning, innovation and change. These empowering and supportive environments will foster modification of values, norms, and beliefs that will allow its cultural members to effectively integrate technology into their curriculum. Transformed cultures will be able to develop the capacity for change, which leads to beneficial improvements, including those which involve technology.

Introduction

Over the last thirty years there have been numerous attempts to bring about reform or change in educational institutions. Many of these attempts have failed because the focus was on the change itself, not on the needs and outcomes of the institutions and their clients as reflected by their cultures. We cannot continue to promote change for sake of change and we cannot mandate change (Fullan, 1992). In a similar way, we cannot mandate the use of technology in schools and classrooms. Technology has significant benefits for teaching and learning, but we can't simply utilize technology for technology sake in order to satisfy political agendas that do not benefit students. Once again, the culture of the school is an important key for the acceptance and appropriate use of selected technologies. The technology, which is selected, needs to fit into the cultures' structure, goals, curriculum, and activities not vice versa.

Culture and Change

The word "culture" has different meanings for different people. The definition of culture in Webster's dictionary, that most appropriately fits this discussion, reads "the concepts, habits, skills, arts, instruments, institutions, etc. of a given people in a given period." This definition does indicate that cultures do change, but they also reflect all the characteristics and attributes that make them distinctive. Individuals may significantly represent or display their cultural heritage. The recent focus on culture in social and educational arenas involves diversity issues. Educational institutions are pursuing viable mechanisms and structures for recognizing and accommodating individuals from diverse cultures. These initiatives will usually enhance the existing cultures, but we need to focus, once again, on a culture's ability to change. This involves both cultures, the one being adopted (the adoptee) and the one that is adopting (the adopter) the other. However, we must not lose site of the pecking order, since the adopter culture must survive at all costs.

There are many other kinds of changes that will impact cultures. These include social, political, economic and technological trends and events. In order for a culture to survive, relief of stress and resistance to change are important concerns (Hodas, 1993). Unfortunately, as Lorsch (1986) has pointed out, the culture of an organization can create an invisible barrier to change. A deeply held set of values and norms often

produce a strategic myopia, meaning that members may miss the significance of external events and may be blinded by their strongly held beliefs (Fung, 1992). As a result, decisions and actions not only reflect the organizations' culture, but are constrained by it (Fung, 1992). Since most cultures are well established, changes that may occur, require commitments, take time, and need to be strategically integrated. Hence the most important changes are the incremental ones (Pogrow, 1996). The effective use of technology in schools throughout the country can only be accomplished if leaders and teachers strategically initiate and support changes to modify or re-shape the existing cultures(s) in their schools.

Leaders, Technology, and Cultural Change

Educational Leaders, especially new leaders, cannot approach technology integration or any kind of change as if the institution had no history, values, norms, rituals and ceremonies (Simpson, 1990). They can facilitate changes in their schools and school districts by re-shaping the cultures of those schools or the school district. This re-shaping involves the modification or changing of people's beliefs and values. It also involves changing school norms, which define what teachers are supposed to be and do, how children are supposed to behave, and what constitutes an appropriate and fair set of expectations for a subject (Eisner, 1992). These norms are sometimes convert and shape attitudes, create inequities, and often reproduce the inequities of the society at large (Apple, 1982, Giroux, 1989). This reflects what Pierre Bourdieu has called "cultural reproduction". Often educational leaders find it very difficult to bring about change, which significantly conflicts with beliefs, values, and norms reflected in the schools' culture or reflected in the culture of the community where the school is located. It is fortunate that technology has finally been accepted as a useful tool in many communities, but often community members and educators are not convinced of its role and benefit in schools.

Leaders need to address the reluctance to change and the need to change as seen by community members and educators. In order to address these issues, leaders need to begin a strategic planning process that would involve all stakeholders. These stakeholders would be asked to discuss educational issues that would result in viable solutions that may alter the current culture, particularly its norms and values. This process would also insure that the leader would not impose his/her values and assumptions on the culture and possible improvements (Schein, 1992). Questions that would flush out these educational issues would include:

Who are we?
Who are our clients?
What are our client's needs?
How can we best provide for those needs?

As discussions and interactions take place, cultural members need to deal with assumptions, perceptions, and expectations that may not be accurate or realistic. In addition, various social, political, and economic concerns will impact the proposal development and implementation of certain educational solutions. Educators and other stakeholders need to review research and understand the possible solutions and strategies to these questions in order to buy into the need and feasibility of these changes. The strategic planning process would hopefully yield valuable information in three critical areas for changing organizational culture:

1.) Content of the change – the vision of the new culture
2.) Leverage points for change – what and how to change
3.) Tactical choices – when and where to change (Nadler, Shaw, Walton 1994).

The strategies and support mechanisms that will enable them to be successful will determine acceptance of these changes. When educators and stakeholders actually see and experience the benefits of these changes, they will officially embrace them.

Educational leaders should guide the strategic planning process to insure that some structures, policies, procedures, and practices will be put in place to support modified norms, values, and beliefs. Educational leaders would then employ strategies to insure that these changes are realized. Most significantly the process of change needs to encourage appropriate structure, collaborative environments, and teacher empowerment (Simpson, 1990, Fullan, 1995, Lieberman and Miller, 1990). First of all, technology can be

effectively integrated into a structure that supports a variety of instructional content, teaching strategies and activities to accomplish a variety of student learning outcomes. These structures support the time and resources for professional development and the subsequent design, development, and implementation of instructional activities. This can involve changes in decision-making committees, developed planning documents, policies, procedures, roles and responsibilities, scheduling, and other functional operations, services, and utilization of resources. Second, collaborative environments allow many different teachers and outside partners to utilize their collective expertise and experience in order to design, develop, and implement instructional curriculum that utilize technology tools effectively. Teachers can benefit from shared experiences, ideas and decisions. Finally, teacher empowerment can allow teachers to become continuous learners, innovators, and experts in the change process within an environment that allows for validation, affirmation, vindication, and self-actualization. An environment free of fear, threats, and anxiety allows for creative and innovative uses of technology in classrooms and schools. Educators need this kind of supportive environment as they accept the challenge to adopt a particular innovation and move at their own pace. They will probably move through eight levels of use (behavior)-

1. nonuse
2. orientation
3. preparation
4. mechanical use
5. routine
6. refinement
7. integration
8. renewal (Hord et al., 1987).

In addition, they will probably move through six stages of concern (expressions)-

1. awareness
2. informational,
3. personal management
4. consequence
5. collaboration
6. refocusing (Hord et al. 1987).

Educators, learning to integrate technology into their curriculum, will probably move through these stages and levels until they feel very comfortable and confident. Healthy cultural environments, that are maintained and updated by educators in their schools, will foster beneficial changes for students and teachers, including those changes that make beneficial use of technology.

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Wrestling with the Bear: A School of Education's Struggles to Comply with Current NCATE Standards on Technology in Teacher Education

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Abstract: In late 1997, the NCATE review team strongly encouraged more and varied integration of educational technology into the Freed-Hardeman University's School of Education's courses and into the actual teaching of the courses by the established faculty. Since that time, the author has been charged with the responsibility of integrating a variety of technology programs and projects into our classes, both through the work of the students and as modeled by the instructors. But this has not been an easy task, for while the School of Education has the largest number of majors of any school on campus, the financial commitment toward newer computers and advanced software for education has been difficult to obtain. NCATE seems to be insensitive toward these types of problems, particularly in smaller colleges and universities.

After finishing his dissertation in Instructional Technology, the author was offered the opportunity to work with the School of Education at a small, religiously-affiliated university. Just months previously, the NCATE review team had strongly encouraged more and varied integration of educational technology into the School of Education's courses and into the actual teaching of the courses by the established faculty.

The author inherited a small, out-of-date computer lab of about 15 Macintosh Performa 467s, along with a variety of older Apples, most of which were in the "parts" bin. Soon after the end of the summer term, the Director of Academic Computing managed to arrange for the lab to have 15 new PCs running Windows 98 and MS Office 97. While these new machines were a welcomed addition, they came with a price tag almost out of reach – 10 of the Macintoshes were lost to another lab on campus. The current status of the School of Education's Technology Training Center is 15 new PCs and 5 out-of-date Macintoshes.

As one can imagine, the size of the class that might work in the lab is extremely limited with this type of configuration. No one wants to work on Macintoshes that won't run the newest PowerPC software, such as MS Office 98 for Mac, plus these machines are extremely slow. Clock speeds in the Macs are approximately 25 MHz whereas the new PCs are 300 MHz processors with 32 megs of RAM. Part of this dilemma was solved by working with smaller sections of some of the larger classes and by having comparable software, to an extent, on all of the machines, particularly when designing webpages and researching on the 'Net.

Additionally, it became the author's task to allay the technology phobias and apprehensions of the current tenured faculty, while encouraging them to experiment with the technology in a non-threatening environment. What became immediately apparent in the fall 98 course discussions was that most faculty members were aware of MS PowerPoint as a presentation tool, but had little practical experience using it themselves in the classroom. Further, they did not have the expertise to instruct their students in its use, nor did they have the knowledge of how to the evaluate the student's work in this area.

The author's observation that MS PowerPoint seemed to be the almost exclusive technology tool used in the School of Education classes had been observed by the NCATE review team as well. The author, because of his extensive background in Instructional Technology from Dr. Charles Dickens, Assistant Professor at Tennessee State University, Nashville, offered a variety of suggestions of alternative technology components and offered the expertise and the computer lab time necessary to teach these new technologies to the School of Education students enrolled in fall classes, both undergraduate and graduate. These suggestions were readily accepted by the tenured faculty members!

As the various classes have been instructed by the author in the chosen technology components, the response from the faculty has been encouraging. A wide variety of student technology projects have been accomplished and hosted on the web at http://teach.fhu.edu/technology/ . The students are becoming more comfortable with the technology and the teachers are seeing the tremendous benefit to their courses of the technology-based projects. Several teachers have acknowledged their lack of familiarity with the technology and have asked for private tutorials from the author.

There is wide-spread belief among the school of education faculty that the next NCATE team (Nov. 99) will be pleased with our progress of integrating a variety of technology programs and projects into our classes, both through the work of the students and as modeled by the instructors. But this has not been an easy task. Our current plans are to replace the 5 aged Macs with modern Macintosh G3s. We also intend to have a full computer lab of 15 PCs and 15 Macs. Next would come the software necessary to do the technology projects envisioned by the faculty and staff. While the School of Education has the largest number of majors of any other school on campus, it does not control the purse strings and our Dean will earn his pay getting our lab up to full strength, something that NCATE seems insensitive toward, particularly in smaller colleges and universities.

NCATE's Current Standards for Technology and Teacher Education, available online at http://www.ncate.org/projects/tech/currtech.html , lists five areas of accreditation standards with expectations for knowledge and use of technology among students and faculty. In addition to these standards for the entire school of education, NCATE recognizes three sets of technology standards for use in accredited institutions: the International Society for Technology in Education (ISTE), the Association for Educational Communications and Technology (ACET), and the International Technology Education Association/Council on Technology Teacher Education (ITEA/CTTE). Also, new standards for educational administrators, recently developed under the auspices of the National Policy Board for Educational Administration, include specific expectations for the use of technology in instruction, evaluation, and administration, according to NCATE.

The Virtual Learning Technology Community: Creating and Sustaining Professional Development for K-16 Learning Communities.

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Abstract: Two years ago, the University of Wisconsin System, the state legislature and a number of businesses combined resources and provided funds to support regional and local projects to develop self-sustaining professional development models. Through a grant form the University of Wisconsin Extension PK-16 Initiative, a regional consortium of preservice teachers, K-12 educators, Cooperative Education Service Agencies' staff (CESA), and university teacher educators was established. The grant is in its second year and was redesigned to meet the needs of a broader range of K-12 teachers, preservice teachers, and teacher educators.

Historical Context

The Virtual Learning Technology Community (VLTC) is a three-year project in which the goal is to establish and support a community of regional institutions actively engaged in using existing and emerging technologies to support learning by all members. The project includes several phases that are described below. In practice, the phases overlap, allowing for flexibility in establishing and supporting the community.

In Phase I, which coincided with the onset of year one of the project, activities focused on the identification of personnel, the definition of the roles and responsibilities of each member, and identification of the technology needs of teachers in the target region. Also during phase I, the project web site, was created to provide visitors (namely teachers targeted but potential interns as well), among other things, access to a listing of a range of technology related graduate course offerings and workshops of interest to the participants. The web site's URL is: *http://www.uwec.edu/academic/CI/vltc/vltc.htm* At the same time, teacher educators began identifying potential intern applicants to recommend to the respective schools for interviews, and purchasing the technology equipment necessary to support the interns.

In *Phase II* of the project, attention was directed toward the establishment of links between the VLTC and Regional institutions. At this stage, school sites where teachers were working with technology were identified. Interns were placed with two teachers so the teachers could be released to work on some technology innovations for their respective districts, schools, buildings, or classroom. The interns added some technical expertise, but were also working with the teachers to learn new ways to implement technology in their classrooms. At the same time, teachers, K-12 students, university students, and university educators were developing and participating in courses and workshops in preparation for year two. Those focused on topics such as Instructional Television (ITV and local networks), Computers in Education: On-line Communications and Information Retrieval, Information Literacy, Instructional Design and Development, Technology Gadgets, Creating Multimedia Productions, Distance Learning Networks, and Web Design.

Phase III involved strengthening links among the regional PK-12 schools. It extends and empowers the social context supporting the risks and growth associated with changing teaching and learning paradigms. Through a variety of mechanisms, VLTC participants will share their developing knowledge of current regional projects,

establish communications, and publicize ongoing efforts. These avenues are important because they encourage participants to think about technology as a tool for learning subject matter rather than just learning about technology.

Phase IV will emphasize supporting new projects impacting students in VLTC schools and helping all projects become self-sustaining. Two new projects have emerged as the result of the existing VLTC activities. The Technology Mentors Project (described below) blends staff development in a single large district with opportunities developed for teachers in smaller schools. The Fast ForWord project will bring preservice students, teachers, and university researchers together to examine the efficacy of a web-supported reading remediation program.

Once fully established, the VLTC has a high probability of becoming self-sustaining as members develop shared projects and learn to rely on each other for support. VLTC will support participants' efforts to find new resources, disseminate new knowledge, and extend their expertise to additional PK-12 schools. VLTC will coordinate activities in which participants identify opportunities to continue to work together to develop new and spin-off projects that expand the impact on learners (e.g. parents of students in the K-12 schools, faculty instructors for student teachers and graduate students in the K-12 schools.)

Supporting Staff Development in Rural Schools through Virtual Communities

Affecting change in education requires a change in culture and the consideration of alternatives to the traditional in-service workshop model to teachers and more specifically to those in remote areas. A major goal of the VLTC is to develop distance learning models that are viable for teachers in remote sites. VLTC members have participated in activities ranging from face-to-face hands on workshops to web-supported curriculum design to full-motion distance education courses. The array of offerings included Instructional Television [as a teaching tool (27 teachers at 4 sites participated using the local network)], Computers in Education: On-line Communications and Information Retrieval, Information Literacy, Instructional Design and Development, Technology Gadgets, Creating Multimedia Productions, Distance Learning Networks, and Web Design. Alternative *delivery modalities* were also explored. Some workshops presented new technologies to the traditional audiences of teachers. Other workshops used traditional workshop formats with traditional audiences of teachers. Some workshops have had blended attendance of students, teacher, and teacher educator participants learning together using traditional workshop format and others with blended attendance using new technologies.

Teachers are putting new knowledge to work in their classrooms. For example, two second-grade teachers are collaborating to build a link between classes separated by 120 miles. They are using Nicenet and video-conferencing to foster an interchange of ideas among students and teachers. Each site's second grade students started by using the digital camera to take pictures of each other to send them to the other end via the web. This example illustrates the extension of the community of learners across schools, regions, and cultures. Additional activities stemming from VLTC supported interactions include the use of the Internet by middle school students to study the Arctic Challenge and first grade project using Distance Education help primary grades students meet their peers in another remote school district.

Through the experiences described above, the cadre of teachers guiding students' activities develop knowledge, skill, and confidence enabling them to serve as role models and support systems for others. Some will adopt other teachers and assume mentor roles. Others will continue developing their own projects to better understand ways in which technology is impacting students in their classrooms.

Emerging Virtual Community Activities

Some VLTC projects are long-term efforts to build new communication structures linking preservice teachers with mentors in the building, university supervisors, and peers in other schools. The *Video Conferencing Support for Student Teaching Project* is exploring the role of low-cost video-conferencing to increase supervision possibilities and to link student teachers in remote areas to their campus and to their classmates.

Four options for video conferencing are available to the VLTC constituents. They range from low-end (via Modem) to high end (complete Full Motion). One project is using low-end technologies; i.e. high speed modem, to visit student teaching interns in their classrooms at remote locations. Teacher educators use this medium in an attempt to save commute time and as a potential for opening up classroom doors when placement resources are limited. Real-life classroom examples and feedback from K-12 teachers brought into the teacher education classes have proved meaningful. However, connectivity has been an issue at times and participants have been actively working to remedial the problem and accommodate as best they can. A high-end project has been tested connecting two UW System schools at opposing ends of the state. The main issue with this option is the high cost.

The goal of the *Technology Mentors Project* is to use a multiplier model to establish a building-level support network within a single large district. Teachers with high levels of expertise "the Mentors" will help 2-4 additional teachers develop the expertise necessary to support remaining faculty. In year I (year 2 of the VLTC), six mentor teachers will be identified. The mentors will work with university and CESA staff on issues of adult learning, training models, leadership, team- building, and advanced technology issues. The mentors in turn will adopt two building-level teachers and work with them to enhance their technology skills, help them integrate curriculum and technologies, and prepare them to take on larger technology leadership roles in their respective buildings. In year II, each mentor and building teacher will "adopt" two more teachers and work with them using the same coaching and support model. The overall staff development effort will be supported by the preservice teaching interns assigned to the mentors. The interns will have advanced technological skills and will provide release time and additional support for the mentors and teachers. The activities of the Technology Mentors Project will intersect with other VLTC activities; thus some staff development will involve teachers from many VLTC project sites working together; other activities will emphasize one-on-one coaching.

It is anticipated that the multiplier model from the Technology Mentors Project along with teachers from the other projects contributing and collaborating across districts and regions will reduce the artificial boundaries to student teaching placements and collaboration amongst teachers. It is also expected that the projects that will emerge will be varied in nature and demonstrate creativity. The sharing of ideas and of technology equipment will become second nature to a seamless process.

Evaluation and Assessment

Evaluation of the VLTC focuses on (a) community development and (b) impact on participants. Community development evaluation examines the activities actually used to establish, and sustain the community. Impact evaluation tracks changes in participants' knowledge, skills, and classroom practices that result from VLTC-supported activities.

Community development evaluation maps the goals of phases I-IV against the activities designed to achieve that phase. Some of the activities are recurrent and/or continuous in nature and thus a decision of where best to place them in the table was agreed upon by the authors. (see table 1 below).

Goals	Activities Illustrating Different Phases	Current Assessment Processes
Phase I *Establishing Model*	Hiring of VLTC coordinator Monthly meetings at different sites Identification of K-12 potential schools	Expansion to other schools
Phase II *Establishing Links*	Creation of the VLTC Web site Identification of Teachers and Projects Distribution of pre-test survey	Maintenance of the VLTC web site Expansion and refinement of the sites
Phase III *Strengthening Links*	Placement of the interns and supervisors Provision of the technology tools Provision of professional staff development, workshops and inservices (27 teachers from 4 different schools)	Combination of the "intern fair" (Fall) with the technology intern boot-camp with BITS workshops Linkage of university supervisors in the Technology Mentors Project extension Increase the number of placements (Fall

		semester) New courses CI 495/695 Provide professional development workshops New internship opportunities
Phase IV *Supporting New Projects*	Establishment of the Technology Mentor Project extension Collaboration with local district for professional development plans Linkage to the Human Sciences and Services Study using the Fast ForWord software to determine efficacy for students with reading disabilities	Placement of Technology Mentors' Project interns "Distance" as continued problem in land of snow and ice

Table 1: The Impact of the VLTC on the Development of the Community

Project activities such as meetings, workshops taught by VLTC teachers, outreach activities, support and involvement by preservice teachers are documented and reviewed to identify contributions to building and maintaining the VLTC model. These collectively provide evidence that the model is generating changes in the ways teachers learn about technology, supporting increases in technology-appropriate practices, and increasing collaborative activities involving students, teachers, university educators, and CESA staff. As the VLTC community grows, assessment and evaluation efforts will continue documenting that development is occurring in appropriate ways.

New initiatives and concerns have emerged as a result of the activities developed at each phase. Those are briefly listed in column three of table 1 and will be summarized here. Expanding the model to other schools, districts, and regions is illustrated by the Technology Mentors Project. New internships have been created to involve additional communities in the Virtual Learning Technology Community. Critical issues in regard to placement have emerged: a) the quality of the experiences that are provided for our preservice teachers, and b) the number of placements at each site in order to maximize supervision. For example, an intern was hired to teach word-processing and keyboarding (low-level tasks) while the teacher worked with higher levels of technologies. In another case, a single placement at a distant location required the supervisor to drive further distances. Another drawback is attracting more interns to distant placements. Inclement weather (ice and snow in spring) is another drawback. Identifying new cooperating teachers with technology savvy, and developing new student teaching placements have alleviated some of the issues. Furthermore, clusters of interns and student teachers are being placed at distant sites to enhance supervisory efforts even though placements associated with the VLTC are further than 60 miles away from campus. The development of an internship fair with a technology boot-camp for those students that will be taking on a technology internship is being developed. Joining forces with already available university resources from Bringing Instructional Technology to Students (BITS) workshops, the project will be able to provide adequate "training" for preservice. Also, trying to involve more university supervisors in the Technology Mentors Project and other potential projects will help integrate a greater variety of technologies in the methods classes prior to the student teaching experience. Finally, a new course was designed that will be delivered using distance technologies to provide skills to K-12 teachers who will become cooperating teachers in these virtual community classrooms.

The impact of VLTC activities on participants is being tracked using pre-post surveys, small-group interviews, project artifacts, and workshop enrollment data. In the following table, items listed in Italics were identified as foci for the future of the VLTC

Populations Targeted	Documentation	1999-2000 *Focus*
K-12 students	Projects artifacts	*Small group interviews*
K-12 teachers	Survey pre/*post*	*Workshop enrollment data* *Small group interviews* (informal)
University students	*Exit interviews with VLTC Interns (survey)*	*Establishment of competencies*

University faculty	Survey pre/*post*	*Access for modeling* *Focus on classroom teaching* *Involvement of more teacher education faculty* *Curricular change*
UW-System	Proving it works symposia: Wisconsin Educational Technology Conference SITE 98 SITE 99	

Table 2: The Impact of the VLTC on the Different Populations Targeted

Data from a technology needs and practices survey is currently being compiled to build portraits of the knowledge, skills, and comfort levels for teachers in schools served by VLTC projects. In addition, artifacts from workshops, interviews, and classroom projects provide rich qualitative evidence of changes in teacher and student knowledge, classroom practices, and the interactions among curriculum, instruction, and assessment.

The technology needs and practices survey (Hollon and Hartfeldt, 1997) asks respondents to rate their knowledge, use, and student use of 55 technological tools and practices involving hardware, software, telecommunications, and networking resources. The survey also asks participants to rate their knowledge and confidence relative to the ISTE standards for teacher preparation.

Currently, data for 142 teachers are available. These data represent a partial set of pre-project responses. Detailed analyses are ongoing and will be reported separately. Items describing everyday hardware and technology (VCR, overhead projectors, personal computers) received highest ratings of knowledge and frequency of use by teachers. Respondents report much less knowledge about scanners, digital cameras, and image manipulation tools, and seldom require students to use them. Items related to subject specific software, problem-solving software, simulations, networking tools, and curriculum development received low ratings, with groupware, web-authoring software, and project management tools receiving the lowest ratings.

Of particular significance is the difference between teachers' uses of technological tools and their students' uses of those same tools. Our current analyses suggest that, even when teachers view themselves as knowledgeable and comfortable using common tools such as personal computers, word processors, and Internet resources, they use them much more often than they require their students to use them. For example, 82% of the respondents reported that they felt sufficiently knowledgeable about Internet resources to meet their own needs and/or teach uses of the Internet to others. Yet, only 36 % reported requiring students to use the Internet more than 5 times per semester. Such discrepancies need to be interpreted cautiously. Some discrepancies are not surprising; not all tools used by teachers translate directly into student use. Additional factors such as limited access to technology resources for students, limited curriculum-technology transformation, and inadequate staff development might account for other gaps in use. Overall, though, the data clearly show that teachers are using technology much more than they require students to use it. .

Most survey respondents report that the ISTE standards (ISTE, 1997) are very important goals for preservice teachers; only one standard (of thirteen) related to research and development of appropriate assessment practices was rated as important or very important by less than 90 per cent of the respondents. In contrast, most teachers felt unprepared to help students meet the standards. Only five of the thirteen standards were rated by at least 50 per cent of the respondents as items they felt prepared to help students achieve.

The survey data provide only one view of teacher and student uses of technology. As VLTC projects develop, we hope to see increases in the numbers and types of items rated in the knowledgeable/confident category, fewer items rated as unfamiliar, and smaller discrepancies between teachers and students' uses of the same technological tools.

Analyses of other data continue. Artifacts from workshops show a rich array of products ranging from web sites to communications centers to Internet-supported content instruction. Teachers are quickly developing skill

in using distance education technologies. Barriers between students and teachers are tumbling as comfort levels increase. Student experts are working in formal and informal capacities through web design, coaching peers, offering support and assistance to building teachers, and sharing ideas over the Internet. In short, the community is healthy and growing.

Summary

The process of establishing different phases of developing the VLTC proved effective in that it has opened up lines of communications at different levels. Technology is a "great leveler" as the different constituents of the VLTC work together in the context of changing knowledge and emerging technologies. In this model, K-12 students and teachers and university students and teachers can learn together. Collegial conversations and learning grew directly from teachers' experiences with their students. Teachers ranged from novices with technology to using it to modify their instructional methods. More data is being compiled as we look onto year three of this project.

The graduate education curriculum: the process of change in an instructional technology program

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Abstract: In the Fall of 1998, Curriculum and Instructional Technology faculty undertook the task to revise an existing Masters program to better focus on technology in teacher education. In this paper, we describe the evolution of our program and discuss several important qualities that support programmatic reform efforts. The ideas are relayed as a status report on the change process at the time of this writing. Any errors are the authors' responsibility alone.

Introduction

In the fall semester of 1998, seven faculty members in the Instructional Technology (IT) section convened on several occasions in order to revise an existing Masters program to focus on technology use in teacher education. At Iowa State University (ISU), the Instructional Technology section is located within the Curriculum and Instruction department at the College of Education. Degrees awarded with a specialization in instructional technology at the Master's level include the Master of Education (M.Ed.) and the Master of Science in Education (MS). In this paper, we describe the evolution of our program, discuss issues and challenges we faced, and describe qualities which supported the process of change.

Program History

The history of an educational program conditions the nature of the program and the way in which developments proceed. At ISU, the Masters program in Curriculum and Instructional Technology dates back about 25-30 years and emerged from two groups with different major orientations: a traditional non-computer media group and a computers in education group. The traditional media-in-education group was typical of instructional technology in the 1960s and 1970s and focused on non-computer-controlled technologies, video, and, to a lesser extent, on the traditional instructional design process. The second group emerged in the late 1970s/early 1980s with the development of microcomputers and the possibility of widespread use of microcomputers in education. This group was excited about the educational possibilities

of computers, but, perhaps somewhat uniquely at ISU, came from a teacher education background more than from the traditional media background.

The distinction here is subtle, traditional media was part of teacher education in a programmatic sense, but the focus was more equipment-oriented; while the teacher education focus was more on the learning-teaching process. Two unique factors at ISU were that there was no group strongly focused on instructional design theory and that educational psychology, from which many instructional technology theorists emerged, was housed in the Psychology Department in a separate college. The latter factor tended to reduce collaboration between Instructional Technology and Educational Psychology.

Thus, in the early days, one camp had a lot of emphasis on media and on producing media specialists, and the other camp focused on using the emerging computer technology for learning and teaching. The small number of faculty in the program prevented groups from developing into separate programs of study. In time, these groups gradually merged as digital technologies became the dominant force in IT. As one of the participants described it: "We had the computer people and we had the media people, then we would have these big discussions. It was almost as though we had computer graduate students and media graduate students. Then it was just sort of interesting how that all kind of dissolved as the distinction between computers and media dissolved itself."

Historical Development of the Curriculum

The distinction between the camps influenced the nature of the curriculum. The original curriculum was primarily media oriented. It focused on technologies that produced alternative media (e.g. photography, video, audio) and on the library science aspects of the media specialist position. As the computer camp emerged, courses were added on top of the existing curriculum. Of course, faculty members' individual interests, the perceived needs of students, and the rapid pace of technology change influenced course development. The content of courses changed as interests and perceived needs changed. When LOGO was a hot topic, a course might focus heavily on teaching Apple II Logo. A few semesters later, HyperCard might be a major topic. The program grew incrementally by adding new courses, but there was no systematic attempt to create an integrative rationale for the program.

The strong need in the state to prepare technology leaders in the schools also played a role in rethinking program revisions. The program accepted a large number of students to prepare graduates to meet this need. While many of these students were primarily practice-oriented, they needed to complete research-oriented theses. The tasks of covering courses and guiding a large number of students stretched the small faculty pretty thin and made the task of rethinking the graduate program seem overwhelming.

Rationale for Change

In recent years, changes in faculty through retirements and new hires led to changes in interests. A faculty member with a strong instructional design theory emphasis was hired. Educational psychology was moved into the C&I Department. The University began a quest to assume leadership among land-grant institutions, and this quest led to the idea that departments needed to focus resources on a limited number of areas that could achieve national and international prominence. Within C&I, teacher education and IT were among the focal areas. A research Center for Technology in Learning and Teaching was established and, because of the interests of the players, developed as its emphasis: technology in teacher education.

The need for a large number of leaders in the area of technology in schools also acted as an impetus for change. Faculty recognized that the existing program did not adequately prepare teachers interested in positions of leadership. All of these changes contributed to the sense that there was a need to develop a focused rationale and direction for the graduate program.

Process of Change

In the Fall of 1998, seven faculty members from a Curriculum and Instructional Technology section at Iowa State University participated in extended faculty retreats to discuss the revisions to the

existing Masters program in instructional technology. While work on this project is ongoing, the process of change was productive and engaging. What follows are descriptions of several areas that facilitated our discussions regarding program reform.

Collaborative Community

Perhaps one of the most critical factors in this process was the existence of a collaborative faculty team. A restrictive sense of ownership over individual courses did not exist. One faculty member, reflecting on our discussions, noted, "It doesn't work to say you can do what you want with the rest of it, but don't change [my class] because that's my course." Individuals focused less on making changes to particular courses and more on improvements to the overall program structure.

In addition to a positive working relationship among all faculty members, meetings were organized and had a clear, forward-moving direction. A section leader focused our attention on specific, attainable goals during the meetings and assigned tasks to make follow-up meetings equally productive. While equal ownership in the process was important, one individual focused our attention by structuring meetings and setting the agenda for future meetings. Small group work was highly productive and produced various ways of looking at the program structure. We would leave each meeting with a new assignment and come back ready to discuss our ideas and listen to those proposed by the groups. Everyone felt that change was necessary and that it was important to develop a more focused program.

Shared Purpose

During our first meeting, we set the stage by revisiting our program goals to ensure that everyone shared the same goals. One of our initial discussions centered on clarifying who should we serve. We recognized that we could not meet the needs of every potential student. IT attracted interest from students from all areas such as art, agriculture, training and development, and business. However, the interests and strengths of the faculty and the idea of focusing our resources led us to agree that we wanted our IT program to focus on technology in teacher education. Given our history and recent changes in the staff and University, we felt that now was the perfect time to revise the program. The common agenda or focus on technology in teacher education facilitated our discussions.

Tabula Rasa Design

In the beginning, C&IT faculty faced one important question. Should we take into consideration the existing courses we offer and build from there? While this seemed to be efficient on the surface, it became clear that if we wanted to design a program to meet our goals, we needed to start with a blank slate in order to design what we believed to be the ideal program for our Masters students. Keeping existing courses in mind at the beginning of this process might have prevented us from focusing on the real task: to develop the "ideal" Masters program. We agreed that it would be better to start over again, determine what we as a team wanted to do, and decide what we wanted the program to look like. Released from having to work within existing constraints, C&IT faculty divided into two small groups to develop proposals for the new program. Succeeding meetings were scheduled to discuss proposals and negotiate through the details of what would eventually become a common core of classes.

Establish a Common Core

Prior to making any revisions to the program, the M.Ed. and MS degrees each required a minimum of 30 semester credits of acceptable graduate level work. Of these 30 hours, Masters students in IT were required to take one course each in instructional media, curriculum, educational computing, research design or statistics, and psychology of learning. Students completed the remaining credits for the instructional technology specialization by selecting available courses offered by different faculty members. While seemingly flexible in appearance, the lack of a cohesive course of study presented some areas of

concern: students shared limited experiences, and course content oftentimes contained repetitive elements. A faculty member noted:

> *"Looking at our existing graduate program, it was clear that while we had a lot to offer, there was a lack of continuity between the courses in the program. What we tended to do was just to add courses without really looking at the entire picture. The problem was that we let the program develop that way and didn't spend a lot of time looking at the entire program. It was like a menu that kept expanding based on peoples' interest."*

A reconceptualization of the program curriculum as an interrelated set of experiences was needed and a better defined core curriculum served this purpose. With this in mind, faculty members identified and examined several instructional technology programs across the nation. Program data was accessible via information found on World Wide Web sites. During a follow-up faculty retreat, individuals described various program configurations in existence. Our discussions afforded opportunities to examine underlying structures found in different instructional technology programs and allowed us to craft our own structure based on the goals and needs for our program. The most recent draft of the program identifies four major focus areas: research, foundations, applications in IT, and leadership. Table 1 lists courses within the new program requirements.

	M.Ed.	MS
Research	• Action Research and Assessment	• Educational Research • Advanced research course (Quantitative or Qualitative) • Research in Instructional Technology • Research Practicum
Foundations	• Foundation of IT • Foundations of Curriculum Theory and Change • Theories of Designing Effective Learning and Teaching • Social/Historical Foundations of Education	• Foundations of IT • Theories of Designing Effective Learning and Teaching **-- and one of the following --** • Curriculum Theory • Learning Theory • Instructional Theory • Communications Theory • Computers and Cognition • Critical Analysis of Information Technology
Applications in IT	• Design & Development of Media (1) • Introduction to Using Technology in Learning & Teaching • Advanced Integration of Technology in Classrooms • Practicum	• Introduction to Using Technology in Learning & Teaching • Advanced Integration of Technology in Classrooms Prof. Seminar
Leadership	• Technology Diffusion, Leadership and Change -- **OR** -- Organizing and Managing IT Support Services • Seminar in IT (1)	• Seminar in IT

Table 1: Proposed <u>core</u> course requirements (3 credits each, variable credits shown in parentheses)

Of importance was the decision to increase the number of required credit hours to 36 credit hours. While our initial program required students to complete 30 semester credit hours, a cursory examination of instructional technology programs revealed a 36 credit minimum at many other institutions. The revised program allows some flexibility yet ensures that students experience a common foundation. In addition, the distinction between the M.Ed. and MS degree becomes more apparent.

Meeting Different Needs

Masters students pursuing a specialization in IT mainly fall into two categories. The MS degree was designed to for students with an interest in continuing an emphasis on research. The M.Ed. degree was designed for practitioners – full time teachers who come with a different vision of why they want their degree. Initially, the distinctions between the MS and the M.Ed. degree were not clear. The main difference was that students interested in earning the MS degree wrote a thesis and those pursuing the M.Ed. degree engaged in a creative component requirement.

Over a span of several meetings, C&IT faculty discussed how to better serve the needs of both groups. While the four core strands remained the same, efforts were made to address differences (for example, although the research strand is important to both degree candidates, MS students were required to take 9 additional research credits while the research course for practitioners emphasized more practical action research methods). In addition, the new program was designed to give Masters students *choices* as to whether to write a thesis, develop a professional portfolio, or engage in a creative component. Many Masters students with no intentions to go on for a Ph.D. will have the option to create a professional portfolio or engage in a classroom application project. For the student that not planning to pursue a research area, this serves as a more useful, more practical activity. Students have more flexibility in deciding what would be in their best interests based on their professional goals and future career choices.

Next Steps

At the end of the semester, it was clear that the proposed changes were not superficial but were rather substantial in nature. It is important to note that at this time this paper was written, work on the program revisions had not been finalized. While flexibility is important, clear goals and thoughtful design are critical. We know that our efforts will result in a program that is more focused and better able to meet the needs of our students.

Change Theory for Schools: Some Basic Principles

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Abstract: There are tremendous pressures on K-12 schools to adapt to a wide variety of expectations (e.g., state and organizational content standards, professional standards, site-based management, technology utilization and integration) that are all related to our capacity (individually and institutionally) to cope with and facilitate change. In general, school reform is inherently dependent upon change. While most administrators have had some exposure to change theories and their application, the large majority of practicing faculty and preservice teachers have no knowledge of these perspectives; nor are they aware of how the theories can be applied to facilitate change at a micro or a macro level. This paper provides a brief, practical introduction to two specific change models: Rogers' Diffusion of Innovation Theory and Hall and Hord's Concerns-Based Adoption Model (CBAM). An extensive bibliography of related readings is included.

Introduction

Change adds an additional layer of complexity to the already overburdened role of the classroom teacher. Offering opportunities to explore strategies so teachers better understand change may bring some relief to the syndrome of 'teacher burnout' and frustration with peers and/or administration. Additionally, it is a given as we approach the new millennium that change has developed into the one constant of our personal and work lives. There is a reciprocal relationship between change initiatives in our schools and classroom teachers--they are mutually influencing. This paper is intended to provide the reader with background knowledge in some basic principles of change and diffusion from Rogers' Diffusion of Innovation Theory and from Hall and Hord's Concerns-Based Adoption Model (CBAM). Key principles are included in this overview from such related theoretical constructs as: adopter categories, diffusion, critical mass, change facilitation, user levels, stages of concern, and other fundamental constructs essential to theoretical application in school settings.

In 1992, Salisbury and Conner wrote, "The increased volume and complexity of change requires educators to develop the critical skill of managing change. Fundamental to the skill in managing is the capacity to absorb change without dysfunctional behavior, operating at the optimum speed of change, enhancing resilience, and understanding the structure of change" (p. 1). Understanding basic principles of change can only serve to help those involved with change to adapt more successfully and with fewer struggles. Some basic principles apply regardless of the change theory or model: *Change is a process, not an event*; *Change cannot occur without disruption of a system and systems prefer to stay at rest; Change causes ripple effects throughout a system; Change occurs as states of disequilibrium transform into states of equilibrium;* and *Change is typically embedded in ambiguity and risk.*

Diffusion of Innovation

Rogers (1995, p. 5) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system." Rogers (1995) presents numerous examples of diffusion efforts, all of which have four identifiable main elements: an innovation, communication channels, time, and a social system. In the brief sections that follow, the reader will find abbreviated summaries of key constructs and terminology from Diffusion of Innovations Theory. The reader is encouraged to read Rogers (1995) for adequate treatment of the topic and extensive examples of diffusion research.

Characteristics of Innovations

How quickly an innovation is adopted (or the rate of diffusion) is often affected by the characteristics of the innovation. It is the *perceptions of individuals regarding the innovation* that will affect the time required to reach widespread adoption. Rogers (1995, pp. 15-16) describes these five characteristics: RELATIVE ADVANTAGE (Is it better than what it is intended to replace?); COMPATIBILITY (Is it consistent with the norms of the social system?); COMPLEXITY (Is it more or less difficult to understand or use than what it is intended to replace?); TRIALABILITY (Can I try it out?); and OBSERVABILITY (Are the results of using it visible?).

Adopter Categories

After decades of research in this area, Rogers (1995) has identified five categories of adopters. Diffusion research verifies that the members of each category have much in common. One should note, however, that each of us will likely fall into a different category dependent upon the innovation and our individual perceptions about the characteristics of the innovation. The categories are distinguished on the *degree of innovativeness* of the members. Rogers (1995, p.22) lists these adopter categories, followed by the validated statistical percentages of the social system membership that is adopting the innovation: INNOVATOR (2.5%); EARLY ADOPTER (13.5%); EARLY MAJORITY (34%); LATE MAJORITY (34%); and LAGGARD (16%). Diffusion of Innovation Theory provides detailed descriptions of the membership characteristics of each category (see Rogers, 1995, Chapter 7).

Rate of Adoption

"The rate of adoption if the relative speed with which an innovation is adopted by members of a social system" (Rogers, 1995, p. 22). When numbers of adopters are graphed against time, the resulting *adoption curve* is an S-shape. Innovations that are rapidly adopted are represented by very steep S-shapes, while slower adoptions are represented by lazy S-shapes. A related construct is that of critical mass. Critical mass theory lays the foundation for understanding the size of the adoption audience necessary for the adoption rate to become self-sustaining (Rogers, 1995). Critical mass mathematically occurs at the first inflection point of the adoption curve.

The Innovation-Decision Process

The innovation-decision process can result in either adoption or rejection of the innovation. It is both a process of information gathering and information processing. The process may occur at an individual, unit, or organizational level. Many other individuals (see next section) play key roles in the process when the innovation-decision is made at the system level. The five steps in the innovation-decision process include: KNOWLEDGE; PERSUASION; DECISION; IMPLEMENTATION; and CONFIRMATION (Rogers, 1995, p. 20). There are a number of decision points in the process that may be influenced by the innovation characteristics, the rate of adoption, and the characteristics of the adopter categories.

System-Level Diffusion

Diffusion of innovation at the system level requires careful planning, participation and support of others in the system, and attention to the design of interventions that facilitate adoption. Rogers (1995) describes the characteristics and the roles of the CHANGE AGENT; OPINION LEADER; GATEKEEPER; and the INNOVATION CHAMPION.

Concerns-Based Adoption Model

The Concerns-Based Adoption Model (CBAM) (Hall, Wallace, & Dossett, 1973; Hall & Hord, 1987) is a change implementation model founded on school practice. One of the important perspectives of the CBAM approach is that "there must be an understanding of how the individuals within a school become confident and competent in using educational innovations" (Hall, 1992, p. 884). CBAM has a strong history of research on practice in schools, with teachers and principals, and classroom innovation implementations. The model is comprised of three diagnostic dimensions: stages of concern (SOC), levels of use (LOU), and innovation configuration maps (ICMs). Each diagnostic tool has a unique purpose and is intended for use at varying stages of the change process. Since CBAM focuses on facilitating change and monitoring implementation, it comes as no surprise that the model also emphasizes the use of specialized dissemination strategies, carefully designed implementation interventions, and the role of the change facilitator within the school setting. The reader is encouraged to read Hall and Hord (1987) for a much more complete treatment of the topic.

Survey of Concerns

The SOC is a 35-question survey (Hall, Wallace, & Dossett, 1973) designed for adaptation to use for unique innovations within the school setting. The survey takes about 30 minutes to complete. The instrument is a valid measure (Hall, George, & Rutherford, 1979) of the individual's concerns about the innovation related to self, task, and impact. The survey allows for the development of a Concerns Profile for each individual. The Concerns Profile is a graphic representation of the relative intensity of concern of the individual defined by seven stagess (Hall & Hord, 1987, p. 60): Stage 0 AWARENESS (Little concern about the innovation or involvement with the innovation is indicated.); Stage 1 INFORMATIONAL (A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects, and requirements for use.); Stage 2 PERSONAL (Individual is uncertain about the demands of the innovation. This includes analysis of his/her role in relation to the reward structure of the organization, decision making, and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.); Stage 3 MANAGEMENT (Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.); Stage 4 CONSEQUENCE (Attention focuses on impact of the innovation on student in his/her immediate sphere of influence. The focus is on relevance of the innovation for students, evaluation of student outcomes, including performance competencies, and changes needed to increase student outcomes.); Stage 5 COLLABORATION (The focus is on coordination and cooperation with others regarding use of the innovation.); and Stage 6 REFOCUSING (The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation.)

Levels of Use

The LOU concept assumes a range of different types of use of an innovation as well as different amounts of use (Hall & Loucks, 1977; Hall, Loucks, Rutherford, & Newlove, 1975). Levels of Use are operationally defined in eight levels (three nonuser and five user). Two fundamental concepts underlie the LOU as a measure of implementation of an innovation. One, "teachers construct meaning of the innovation and interpret the innovation differently at different times in the change process" (Hall, 1992, p. 892). Secondly, "use of an innovation is not dichotomous" (Hall, 1992, p. 892). The levels and general behavioral indicators are: VI RENEWAL (The user is seeking more effective alternatives to the established use of the innovation.); V INTEGRATION (The user is making deliberate efforts to coordinate with others in using the innovation.); IVB REFINEMENT (The user is making changes to increase outcomes.); IVA ROUTINE (The user is making few or no changes and has an established pattern of use.); III MECHANICAL USE (The user is using the innovation in a poorly coordinated manner and is making user-oriented changes.); II PREPARATION (The person is preparing to use the innovation.); I ORIENTATION (The person is seeking out information about the innovation,); and 0 NONUSE (No action is being taken with respect to the innovation.) (Hall, 1992, p. 893).

Innovation Configuration Maps

CBAM defines an innovation "in terms of key operational components and distinctions are made between the different variations that can occur for each component" (Hall, 1992, p. 886). Consequently, it is the configuration of the actual implementation(s) of an innovation that is of particular importance to the change facilitator. Components of the innovation are often comprised of "a set of operational skills, practices, and uses of resources" (Hall, 1992, p. 887) that influence implementation of the innovation. ICMs are developed to measure implementation at the component level (Heck, Stiegelbauer, Hall, & Loucks, 1981). Clear definition of these components is often made more difficult by attempts to implement bundles or stacks of innovations within narrow timeframes. Time is a necessary requirement for change to occur, but it is not a sufficient condition. Support, holistic perspective, and combined effort are also essential for institutionalized change to occur. The development and formative evaluation of ICMs provide change facilitators a clear strategy for the management and monitoring of innovation implementation.

Conclusion

The demands on our schools and the people who work in them to adapt to dramatic change show no sign of abatement. Given that, and given that some change will have positive results for the system, the challenge for each of us is to be aware enough of some fundamental principles associated with change that we are better able to understand, accept, and help facilitate the individual and collective process. After all, since there is no end in sight, it is the journey that is important.

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More than Technology: Reflections on a University Internship Program

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Abstract: In a project inspired by the Generation Why program, Winona State University College of Education students have begun assisting faculty members as they work to infuse technology into their courses. Along the way, the student interns have learned much about technology, working together to learn about technology, and the struggles and successes that accompany a project such as this. Assisting the faculty in integrating technology into their courses "turned the tables" on the traditional teacher-student relationship. The students learned as much about working with faculty as they did about technology. This paper focuses on their relationships with faculty and the difficulty of fitting into the schedules of faculty who initially look at technology as another "add-on, teaching your teacher, maintaining a human side to technology, and entering a "community of learners."

Introduction

In a project inspired by the Generation Why () program, Winona State University education students have begun assisting faculty members as they work to infuse technology into their courses. Along the way, the student interns have learned much about technology, working together to learn about technology, and the struggles and successes that accompany a project such as this.

As in the Generation Why program, interns were not expected to be technology experts, but were expected to accept the challenge of working with faculty as they begin infusing technology into their teaching. The interns agreed to participate in bi-weekly meetings, informal training sessions, and independent study of instructional uses of technology. It was hoped that participating in the program would benefit both the interns--who would gain a more sophisticated understanding of instructional technology—and the faculty with whom they worked—the faculty would also learn about instructional technology and increase the presence and quality of technology in their courses.

The student interns were each assigned to a faculty member. The interns were asked to set up an initial meeting with their faculty member to discuss the faculty member's interest in technology. The interns reported what they learned at the second intern meeting and solicited assistance learning the software or techniques requested by their faculty members. After exploring the software with other interns, working through tutorials, and learning about the software in anyway possible, the interns returned to their faculty members and assisted them in using the technology.

[1] The interns' names are presented in alphabetical order and do not signify their contribution to this proposal or project. All interns contributed equally.

Although not all of the attempts to infuse technology were successful, many faculty members have expressed a sincere appreciation for the interns. For the first time, many faculty members felt as though they had the support necessary to begin using technology in their courses. And, in the end, the project has resulted in an increase in attempts at using technology. But rather than focusing on increased use of technology in the university courses, we have chosen to focus on what the interns learned by participating in this project.

Besides their newly constructed knowledge of educational uses of technology, the interns learned a tremendous amount from interactions with faculty that might inform future attempts to implement similar programs. Our presentation consists of four presentations by student interns from Winona State University as well as an introduction and conclusion. The four intern presentations will discuss: a) the difficulty fitting into faculty members already full schedules; b) Mentoring their mentors; c) Maintaining the human aspect of technology; and, d) learning from peers. Each of these presentations are described in more detail below.

Faculty Schedules

University faculty members have notoriously busy schedules. Along with their teaching requirements they are expected to serve on committees, conduct their own scholarship, and conduct professional lives away from the classroom. Asking them to add one more thing to the list is, in many ways, asking for trouble.

Fullan has argued that top-down staff development directives will fail. Teachers are resistant to change when it comes as a set of orders. In order to achieve "real" change, he continues, teachers must recognize the need for change and determine ways to address the need. In addition, Cuban has documented a cycle where teachers have been given technology and told to use it. Most times, these efforts have failed and have resulted in "teacher bashing"—something we desperately wanted to avoid. Both of these arguments suggest that getting the faculty to adopt technology and use it in appropriate ways will work only when we address their needs and if something needs to be dropped from their already overcrowded dockets, it is likely that infusing technology into their courses will be dropped.

Many people who are not technologically fluent have remained so because they are intimidated by the idea of technology since it often appears to be much more sophisticated than it truly is and also because it is quite expensive to purchase equipment initially. Those who are seemingly dragging their feet technologically often raise questions which are aimed at technology's shortcomings, such as the possible problems which could result from Y2K and the seeming loss of personal contact which we often find, especially when calling companies and other large organizations. Other justifications these people may use for not learning about technology often include: "Why should I learn about this when the old way works just fine?" And, "by not knowing about technology, I'm saving myself a lot of time that would otherwise be wasted on the learning process, besides, isn't technology always changing? I would constantly be having to update myself." My personal favorite, "it is just easier to not know."

However, those who support technology could counter those questions with their own. Several counter examples may be: "Hasn't the introduction of electronic mail (email), in essence, allowed us to rediscover the skill and importance of letter writing?" And, "while punching buttons in order to direct ourselves through a phone call may seen bothersome and needless, wouldn't many of us rather spend those few minutes punching buttons than paying these companies even larger fees in order to pay an operator to greet and direct each call?" However, my favorite is, "of course you don't have to learn about technology! You simply need to learn those 6 magic words--'would you like fries with that?"

In response to those who question the need for technology as a whole, we ask, "Hasn't it been evident throughout history that there have always been people who were satisfied with 'good enough'? However, it has never been those people whom we read about in history books as making a difference in the world around them, but rather it is those who have pushed the boundaries of 'good enough' and stretched them until they broke down and became 'even better'."

These examples do not even begin to touch the topic of technology and its conflicts/benefits. The real question I am posing, while my opinion may be biased, is "does everyone truly need to be technologically fluent or are their "old school" methods sufficient in today's society?

Mentoring your mentor

Even when the interns gained access to the faculty's schedules, they found themselves in a unique situation. They were teaching their teachers. Working with faculty in new ways created new relationships for students and faculty members.

As students, we look up to professors and teachers as mentors. They liberate our imagination by encouraging us to develop through mentorship and empowerment, encouraging us to evolve into scholars, professionals, and independent thinkers. As a result, we often seek to emulate our mentors, often times holding our professors in such high esteem, that we place them on a pedestal, projecting expectations and superhuman attributes onto them that the Man of Steel could not aspire to—"How do they know all this stuff?" This is often the nature of the student-professor relationship.

In considering this relationship, it can be very intimidating to turn the tables and mentor your mentor. Closing the gap between teacher as teacher and teacher as student is disconcerting. We all have something to offer others, but how can we mentor a person that we hold in such high regard? Fear and self-doubt are rampant in the student. Other doubts arise: What if I cross the border of professionalism between student and professor? What is the border? Will I hurt my credibility in some way? What if I do something wrong? The most prevalent question is "do I have the tools and information to teach them the things they need to know." All questions and fears aside, the students at Winona State University dove in and began the process of trial and error in "The Winona State Technology Internship Program."

The traditional roles of students and professors working together were soon crossed; WSU students began mentoring their mentors. There were numerous expectations at the start of this program; some held true and others were laid to rest. Difficulties arose for students because of the dissonance created in not having a schema for dealing with situations like this. But being put into this situation led to the construction of new relationships with faculty and a new self-confidence in student mentors as they saw what they could do.

WSU is a unique learning situation, but not so unique that other campus' cannot implement a program such as ours. Wherever there is a teacher, there is also a student. A teacher is one who models what it is to be a student. A teacher attempts to instill the joy of learning through example.

This program has shown us that our mentors are very well learned, but they don't know everything. In fact, this experience has probably been a relief. Now they can dress at home rather than in faculty phone booths and become mere mortals once again. In allowing us to interact with them in a non-traditional role, they have taught us more than we could ever have learned in the classroom. They have shown us how to be a graceful beginner, a good student, and what it is to be in the teacher's chair. More importantly, we have learned that teachers are learning from those whom they are teaching. It is proof that learning never ends, it is truly reciprocal, and that we are always teachers, even when we are the students.

This program has been a great example of reciprocation: the teacher becomes student, and allows the student to become a teacher. Because of this, we all learn, and raise each other to the next level. But success with a program like the WSU Technology Internship Program is dependent on reciprocation and participants being ready to let down their guard and learn from their students. Every one has to want to be involved. With a desire to learn, this program has helped us all to stretch our boundaries of self-discovery and knowledge a little further.

Maintaining the Human Side of Technology

Expectations can be dangerous when it comes to working with people. They can best be described by picturing the person we are supposed to help behind a clear sheet of plastic. We see the person through the plastic, but as we start projecting our expectations on it, our vision of the person on the other side becomes obscured. We must have a clear vision of the person we are to help and train if we are actually going to actually help them. We must make sure that we maintain the human aspects of technology.

Many of us who are proponents of integrating high technology into education feel that technology is the key to creating a better quality of education. This is true, but the computer is not a cure all. The computer is a tool. It is a means for creating more time for human contact and better communication. We must not lose sight of this simple fact. There is no reason for expecting people to integrate technology just

for the sake of technology. In my experience, I have found that technology rarely ever reduces the quantity of work at hand. It has improved the quality, but with the constant upgrade of new programs and new developments in hardware, it is about all we can do as busy individuals to keep up.

Just because a class can be taught through a url address does not mean it is the best way to teach the class. Technology has its uses and place. The computer at its best is a catalyst, a conduit, and a theme. It is a catalyst in that it can bring us together to talk about and learn new things, a conduit because it becomes a means and a channel through which to communicate over time and distance, and a theme because most of us deal with it on a day to day basis and talk about it like the weather--inclement or foul.

My faculty member and I went running for some of our meetings. The key was making the effort to find common ground in addition problem solving in front of a workstation. Relationships should be reciprocal and help us evolve beyond whom we are at the present. The teacher should be open to being a student as well as a teacher. By creating an environment where we can spend a few minutes breaking the ice and finding commonality, technology training was easier to think and talk about. These meetings were very productive in that a technology plan emerged, dated goals were created, and more importantly trust and understanding developed. Because of the trust factor, new ideas were constantly being explored because we were not afraid of looking like a beginner. This allowed us to speak about all kinds of things relating to technology and led to the creation of a protocol for our meetings. We never began the meetings about technology problems. The key to our success was getting to know each other and creating a working relationship through maintaining the human side of technology.

Learning from peers (entering a community of practice)

One major premise of the program was to have the interns work together to solve problems, learn programs, and help faculty infuse technology into their courses. To accomplish this, students met every other week to report on their work and ask other interns for advice. They also participated in a listserv set up to ask questions between meetings.

As the project progressed, the interns began meeting at other times in the education computer lab for informal training sessions. They worked together to share expertise, learn new techniques. In the end, working with each other may turn out to be the most useful portion of the project.

Peer learning occurs all of the time, and is very abundant in the Technology Internship program in which we are involved. Peer learning effects everyone, both the students and instructors. The positive effects of peer learning shine through this program in the computer lab that we maintain and with the interns together. Through this process we are not only learning more about technology, but also developing relationships with other students and instructors.

As we help others in the intern program and in the computer lab, we are developing relationships with more people. We may be known as "that girl who knows about computers" but seeing a regular face is comforting to students who do have questions. We also have the group of interns that are always more than willing to answer any questions that may arise. For example, working through the e-mail program Eudora was unfamiliar, but with the help of another intern it became a more familiar program. He was able to show the different uses of the program and now this information can be passed on once again.

There is a lot to be learned about technology and computers. For example working with the program HyperStudio to make a portfolio was a requirement for an education class. Shannon, the other students and I had very little experience with this program before this assignment. The portfolio included sound, graphics, digitized images, animation and a link to a PowerPoint Presentation. After working through the portfolio and working through the program itself it was becoming more familiar. Working in the lab the night before the portfolio, I found that I was able to answer many questions I did not think I could answer. One thing both of us were unable to do was make the link to PowerPoint, but we learned this through a peer who was working on the assignment and knew. Both of us were really impressed by the student's willingness to help each other even though time was running thin. One reason we are able to help our peers is because we are able to understand the background of the students.

Students are different with their knowledge of computer software. Younger students, recently graduated from high school, seem to have more experience with technology having learned it in school. Returning and non-traditional student generally seem to have less experience and more apprehension when it comes to technology. With my experience with computers I am able to see what younger students have

questions with. Before this program word processing was about as far a technology went for me. I can understand frustrations and confusions these students have because I have been there before. Shannon is a returning student and with the same experiences as myself is able to understand what both the younger and non-traditional students might be having problems with. We are only two of sixteen interns with unique backgrounds in technology.

It is sometimes easier for students to ask their peers for help for mainly two reasons. The first is that the instructor has limited time and peers are able to ask each other questions faster then getting the instructors attention. Another reason is that peers may be less apprehensive to ask each other questions than asking an instructor. Either way, learning from peers has had a positive impact on the effectiveness in our computer lab. Both peers are able to learn something new whether it be how to link a PowerPoint presentation or how to check e-mail.

Conclusion

Through their participation in this project, the interns and faculty members learned more then new technological procedures or processes. Students developed new relationships with the faculty members and learned--and sometimes developed-- appropriate uses of technology in teaching. As a result of this project, the interns will be able to use technology in more sophisticated ways when they enter their own classrooms and the faculty at Winona State University have become more proficient with technology as an instructional tool. We conclude our presentation with a short look at the future by raising the question: Now that faculty members have increased the amount and quality of the technology used in our courses, what role will the interns have in the future?

References

The Pivotal Role of the Department Chairperson in Infusing Technology into a Teacher Education Program

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Abstract: The importance of the department chair's leadership cannot be overestimated. (Bennett and Figuli 1990). This is a key, because the chairperson must simultaneously provide leadership to the faculty and supervise the translation of institutional goals into academic practice. (Tucker, 1992). These two functions must be balanced if a successful change is to take place.This paper deals with how one chairperson was able to lead the effort to integrate technology into it's teacher preparation program by a balanced approach of providing leadership to the faculty and representing the administration in carrying out institutional goals and long term plans. It deals with how the role of the chair was used, how workload assignments were reworked to satisfy both faculty and administration, how technology was tied in with improved college teaching, how conflicts that arose were managed, and how department goals and long term planning were utilized to get limited resources.

Background

We need to be aware of the report issued by the Office of Technology Assessment entitled *Teachers and Technology: Making the Connection,* which stated that technology was not central to the teacher preparation experience in most colleges of education in the U.S., and that too many teachers were graduating with only limited knowledge of the ways that technology could be used in their professional practice. (U.S Congress, 1995). Colleges of education are now attempting to deal with the issue of infusing technology (Drazdowski, 1995, Fox and Thompson 1994) but their attempts are not without problems. One important way that has been successful in addressing the problem and accomplishing this infusion has been to include the entire department in the plan in a concerted effort (Drazdowski, Holodick and Scappaticci, 1996). While this paper recognizes the important roles of all department members in the process, it deals more specifically with the pivotal nature of the department chair's role in the process.
(The term department chair in this paper is a broad designation to include all heads of undergraduate teacher education units, whether the formal title is chairperson, or some related designation).

A Balanced Approach Between Faculty and Administrative Needs

At King's College the faculty handbook states that faculty department chairpersons are considered regular faculty members who assume certain necessary administrative functions, and as such are not

considered as part of the regular administration. As chairperson I had to work within these parameters. I view my role as faculty chairperson primarily as advocate for the education department and the education faculty. However, in no way does that preclude the best interests of the students and the college, and that is precisely why I call it a balanced approach.

First, in order to carry out any kind of positive change effectively it is imperative to have a consensus among the education department faculty that a change is necessary. In this particular case the change we are referring to is an infusion of technology into our Teacher Education Program. I met with the members of the department individually and collectively on this issue. Fortunately, the faculty was of one mind and all agreed that we needed to make a major effort in this area. Additionally, we agreed that we had to have one member of the department with technological expertise to assume an important leadership role in this area. Once the department was fully behind the concept of infusing technology into the Teacher Education Program, my next step was to broach the administration with our perceived need, since it would mean an enormous financial commitment of limited resources. Without the full support of the administration and its administrative prerogatives, any plan to infuse technology into the Teacher Education Program would be futile.

Our college is nationally recognized for its work with strategic and long range planning, so the first thing I had to do was to tie our requests in with the colleges strategic and long range plans. That would be the best way to get the administration's attention. There were two specific existing college goals that I referenced. The first was, "*The college will develop and implement an action plan to make the computer an effective learning tool for students.*" The second was, " *The college seeks to develop a Teacher Education Program which is of the highest quality and most innovative in Northeastern Pennsylvania.*" Our request fit neatly within the parameters of both of these goals, and as a result the college agreed to review our plan to infuse technology into our Teacher Education Program. I do not think that I could overestimate the importance of couching our request in terms of the existing college plan. That was absolutely key. We were on our way.

Some Undefined Roles of the Chairperson

As chairperson, I could not miss an opportunity to promote our infusion of technology plan every chance I got, both formally and informally. It is the informal that I would particularly like to emphasize. It is difficult to quantify the results of all the informal interactions, but I am certain that they were essential in keeping the importance of the plan at the forefront of all of those people who had input into the funding of the program. As chairperson I was in contact with people who could be influential in providing and prioritizing funding, and I never missed an opportunity to promote our program. If I were in the company of the vice-president for finance, I would remind him of our department's extremely positive cost/revenue ratio, and how necessary the infusion of technology would be for us in order to continue to attract students in the future and to maintain our newly achieved position as the largest department in the college. When I was in the company of the vice-president for academic affairs, I would remind him of how this plan to infuse technology into our Teacher Preparation Program was a direct outgrowth of strategic and long range planning, and how it would directly affect the quality of our teaching, since our plan called for each of the education faculty to include in our teaching the very things we were proposing to teach to our student teachers. With the vice-president for technology, I pointed out the absolute need for our student teachers to be on the cutting edge of technology, since they would be exporting it to all the school districts in the area, and it would reflect back on the technology program at King's in a most positive manner if they were all prepared to utilize the latest technology.

Was it politicking? Was I using my long time association with colleagues in influential positions to promote our program? The answer is a resounding yes. but it was a cause worth promoting, and as advocate for the education department, I felt no qualms about it. I believe it was necessary. The end result was our program for infusing technology into the Teacher Education Program was approved.

Reworking Faculty Assignments and Work Loads

The model of management that I personally utilize is one of open communication and shared responsibility. (Hackman and Oldham, 1976). I believe that faculty who enjoys open communication and shared responsibility in the business of the department respond with increased motivation and commitment. As such, our department meetings dealt with the education faculty's role in this whole process. The first thing we decided was that the faculty member with the greatest knowledge and interest in technology had to be the primary change agent. Then we began redefining our respective roles in light of this new technology being infused into the department.

The faculty member who was functioning as the primary change agent was taking on enough additional work to require an adjustment. He opted for an overload contract rather than released time. That being his judgement, it was my responsibility to try to accommodate him. When I pointed out to the vice president for academic affairs that an alternative to granting an overload for our change agent faculty member would be hiring an outside consultant which would not only more expensive, but also much more cumbersome and a lot less convenient, he agreed to the adjustment. The rest of the faculty did not feel that they warranted an overload contract, but they did want support for learning what had to be learned in order to incorporate the new technology into their classes. Support came in the form of funding from a Teagle Grant and workshops sponsored by the college.

Our primary change agent in consultation with the rest of the faculty came up with our wish list. The argument posed to the administration was that our education faculty would need state of the art personal computers for their offices and workstations for their classrooms that included computers, LCD panels, cable and internet hook-ups. The problem that arose here was that that requests of this nature crossed over several bailiwicks and that is always problematical. My role as faculty chairperson was to guide the requests through proper channels and to massage the process in the most expeditious manner, always maintaining the balance between the different vice-presidential areas. Fortunately we were successful and the requests were honored.

Conclusion

Our plan to infuse technology into the Teacher Preparation Program was successful. The education faculty and the administration came to agreement with regard to our respective roles in the process. It was a rewarding experience, since it was cooperative and not adversarial. The request for the major change emanated from the faculty, but we were careful to use the means that the administration had in place for change, namely strategic and long range planning. By working in concert we were able to accomplish a major change. There is an old French proverb which states, *"When it comes to change, people like only those that they make themselves."* In order for the change to be successful, all parties, from the individual members of the education department to the various members of the administration had to feel a sense of ownership in the plan. I believe it was my challenge to remind each of the major factions of the importance of their respective roles. By utilizing an open communication and shared responsibility model, I believe we were able to accomplish it. That is not to say that we did not have our problems or that we do not expect to have problems in the future, but as long as we can maintain a model of open communication and shared responsibility, I believe that we can meet the challenges of the future by continuing to make a concerted effort to be a part of the solution and not a part of the problem.

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Beginning the Change Process: Teacher Stages of Concern and Levels of Internet Use in Curriculum Design and Delivery in one Middle and High School Setting

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Abstract: This progress report delineates processes and procedures in assessing changes in teacher attitudes and behaviors as they utilize Internet for the first time in curriculum development and delivery. The setting is a north Texas rural district serving 1320 students. The sample includes 66 teachers in the middle school and high school. Quantitative data on the Stages of Concern are elicited electronically at three stages in the semester. Quantitative data on the Levels of Use are elicited in face-to-face interviews at the same three stages. Concurrently all teachers participate in a project listserv which provides structure for professional colloquy and qualitative data for analysis. The model provides a framework for the study of change processes relating to various innovation configurations.

Conceptualization of the Problem

Standards

The problem on local, national, and international levels is to use technology as a tool for learning within meaningful contexts to support learning (Kozma & Shank, 1998). National, state, and local standards identify the need to integrate technology into learning processes in our classrooms. In Texas, the standards reflected in the Texas Essential Knowledge and Skills (TEKS) (Texas Education Agency, 1997) include the computer competencies which the learners must demonstrate in the state learning assessment, the Texas Assessment of Academic Skills (TAAS) (TEA, 1997). Thus Texas students are assessed specifically on technology competencies for which teachers and administrators are held accountable.

The State of Texas not only mandates computer competency standards; it also requires districts to submit a three-year technology plan for approval. The Texas Long-Range Plan for Technology 1996-2010 addresses: (1) teaching and learning, (2) educator preparation and development, (3) administration and support service,

and (4) infrastructure for technology. The state offers sizable Technology Integration in Education (TIE) grants to support district efforts. As schools move from *first generation of using technology* to the *second generation of thinking with technology*, computers are moved from labs into classrooms. Increasingly, Internet becomes available there.

Internet in the Classroom

The most significant change in the classroom today is not just a computer, but also direct access to the Internet. This practice is congruent with the four goals in the national long-range technology plans and the goals supported by Texas TIE grants. Access to the information superhighway stimulates dramatic changes in the classroom just as it has in millions of home and businesses. Such innovation calls for significant professional development for teachers at all grade levels and all content areas.

Teaching

Research suggests classroom teachers are under-prepared or unprepared to utilize existing electronic resources effectively (Brownell, 1997; Buhendra, 1996; Clawson, 1996; Fisher, 1997). Basic technical productivity skills are not enough. With the increase in the amount of information available, both students and teachers need advanced skills in analysis, evaluation, and synthesis as the new technologies are integrated into the learning process. The teacher no longer holds all authority over knowledge. She/he must work in the information age to support the development of self-directed, meaningful learning for all students. Experienced classroom teachers must not only become technically literate but also must reexamine fundamental beliefs about traditional classroom approaches now being questioned due to expanded opportunities (Dede, 1998).

Much teaching has been largely dependent on the structure and resources provided in the teachers' guides that accompany the selected texts. This assumes that the teacher dispenses the knowledge through texts and the resource choices that he or she makes. In the Information Age, many of our traditional resources are outdated. Today all need to know how to access the knowledge, check the validity, organize, evaluate and synthesize. Thus, the teacher's instructor role becomes more that of a guide. This role may utilize Socratic questioning that leads to higher levels of critical thinking. Such roles are congruent with the constructivist philosophy that requires a tremendous amount of adaptation and flexibility on the part of the teacher.

Evaluating Change

Change is complex and cannot be forced from the top. The individual is the primary focus of change (Fullan & Miles, 1992; Little, 1993). As state and districts set new learner expectations, as the teaching environment is enriched by new opportunities, and as appropriate professional development supports professional growth, teachers *do* change. This model addresses the changes in concerns and usage behaviors as they relate to the utilization of the Internet as a tool for learning.

Change is not finite, not an event. It is a *process*. This research focuses on the *change process* as teachers change in their attitudes and usage behaviors as an innovation is attempted. In education, study of change has been well established in the Concerns Based Adoption Model (CBAM) (Hord, Rutherford, Huling-Austin & Hall, 1987). Twenty years of research with teachers, administrators, and professors have substantiated the reliability and validity of the two instruments: *Stages of Concern Questionnaire (SoCQ)* and *Levels of Use (LoU)*. These instruments are utilized in relationship to the Innovation Configuration (IC) which defines the innovation central to the change being studied.

In this study the Innovation Configuration revolves around Internet access in the classroom and its use by teachers to develop and deliver curriculum. The research collects quantitative data electronically on the SoCQ and by individual interview on the LoU. Electronic teacher discourse is examined qualitatively in order to identify patterns of concerns and usage. The *Nudist Qualitative Analysis Software (NQAS)* provides a research tool to analyze these qualitative data.

The Research Problem

As national and state standards establish goals supporting use of technology as tools for thinking, the philosophy of classroom teachers and traditional classroom methods are being questioned. This ongoing research evaluates the changing of teacher concerns and usage behaviors as they use Internet in their classrooms for the first time in the spring semester of 1999. District training is designed to support the changes, and electronic teacher discourse is established and supported by researchers. The Concerns Based Adoption Model (CBAM) provides two tools to collect quantitative data (SoCQ and LoU). Qualitative data drawn from the electronic teacher discourse provides interpretative and contextual data and is analyzed with NQAS.

Research Design

This descriptive study of changing attitudes and behaviors toward an Innovation Configuration (IC) examines the experience over one semester of 66 classroom teachers in middle and high school settings. The research collects quantitative data on the SoCQ and LoU at three checkpoints (January, March, and May). Qualitative data are collected from teacher electronic discourse through participation in a listserv related to the project. The first four Hypotheses use SoCQ data to address changes over time of the whole faculty and by three groupings (grade level, school level and content specialty). The next two Hypotheses use LoU data collected in individual interviews to assess changes in usage behavior over time and possible relationships to home Internet access. Hypothesis 7 assesses a possible relationship between stages of concern (SoCQ) and home Internet access. Hypothesis 8 uses path analysis is used to track the relative influence of components of the innovation configuration during the first year of adoption.

Hypotheses

1. No significant changes in teacher SoCQ attitudes are evidenced from the beginning of the semester, mid-semester and end of the semester.
2. No significant changes in teacher SoCQ attitudes by *school level* are evidenced between the beginning of the semester, mid-semester and end of the semester.
3. No significant changes in teacher SoCQ attitudes by *grade level* are evidenced between the beginning of the semester, mid-semester and end of the semester.
4. No significant changes in teacher SoCQ attitudes by *content area* at middle and high school levels are evidenced between the beginning of the semester, mid-semester and year end.
5. No significant changes in teacher LoU behavior ratings are evidenced between the beginning of the semester, mid-semester and end of the semester.
6. No significant correlation between home Internet availability and LoU behavior ratings is evidenced.
7. No significant correlation between home Internet availability and SoCQ attitudes is evidenced
8. No significant correlations will be attained among path vectors of the predicted models of change dynamics.

Sample

The census sample (n=66) includes all middle and high school classroom teachers in one small rural Texas school district. Little Elm Independent School District (LEISD) enrolls 1350 students, of whom 45% are designated at-risk, and 22% are minority students. Approximately 120 teachers are employed as classroom teachers in the four schools: primary, intermediate, middle, and high schools. All middle school teachers (n=27) and high school teachers (n=39) had Internet available in their classsrooms for the first time in Spring of 1999. LEISD is one of eleven district partners in the Community Collaborative Professional Development Centers (CCPDC) sponsored by Texas Woman's University. These eleven districts include two urban, three suburban, and six rural professional development sites. This CCPDC entity encompasses the entire TWU undergraduate teacher education program and university liaisons work with each district.

Instruments

The *Stages of Concern Questionnaire (SoCQ)* consists of 35 items that use a seven point Likert response form. Analysis of the data results in placing the subject at one of eight levels of concern: (1) Awareness, (2) Informational, (3) Personal, (4) Management, (5) Consequence, (6) Collaboration, and (7) Refocusing (Hall, Wallace, & Gossett, 1973). The measure was developed at the Research and Development Center for Teacher Education, University of Texas at Austin, and has been heavily used in the change literature (Fullan & Stiegelbauer, 1991; Fullan, 1993a; Fullan, 1993b, Hord et al, 1987).

Hall, George, and Rutherford (1979) assessed the reliability of the 35 items on the questionnaire. They used Cronbach's alpha to examine internal reliability. They report alpha coefficients ranging from .64 to .83 on the seven scales. Test-retest correlations taken two weeks later used the Pearson r correlations and ranged from .65 to .86. The lowest correlations in both analyses occurred in the Stage Zero scales.

The validity of the questionnaire was ascertained from intercorrelation matrices, judgments of concern based on interview data, and examination of concerns in relation to the amount of time of involvement with the specific innovations. Hall and George (1980) determined that the correlations on the 195-item questionnaire were higher near the diagonal. This finding supported the theory that each scale was more like the ones immediately surrounding it than those farther way (Hall & George, 1980). Reliability and validity have both been examined in subsequent studies and the original suppositions have been supported.

The *Level of Use (LoU)* data are collected by individual interviews. A detailed manual developed by Loucks et al. (1975) supports the focused interviews used to assess the level of use of innovations. A detailed guide establishes a list of objectives and questions but the interviewer is provided latitude within the framework guide. Approximately 1680 interviews were conducted during the validation period. Interrater reliability was established using the detailed examples in the manual, and it was fairly simple to reach 70% agreement or more.

The *Innovation Configuration (IC)* specifies the dimensions of the innovation so that all subjects are focused on the same concept as they share their concerns or level of use. The configuration is clarified in the first training and repeated in every data collection. In this study the IC is the access to Internet in the classroom and the ways and degree that the teachers use it in development and delivery of curriculum.

Demographic Data such as gender, teaching experience, certifications, and degrees will be used to describe the sample. Grade level and content specialty will be used to address Hypotheses 2, 3, and 4. Home Internet availability will be utilized in Hypotheses 6 and 7.

The *Nudist Qualitative Analysis Software (NQAS)* in not an "instrument" in the classical sense, but it is a contemporary software tool designed to support qualitative analyses and/or content analysis. This important addition to this exploratory study provides vital background for designing a larger research effort.

Data Analysis

The seven developmental stages of the SoCQ are transferred to a seven-digit number for facet analysis. Hypothesis 1 (changes over time), Hypothesis 2 (time by school groups) Hypothesis 3 (time by grade level, and Hypothesis 4 (time by content area) are be addressed in these analyses using three-digit configurations from the profile to assess initial, middle, and advanced concern concentrations. Change in these configurations will be separately assessed through t-tests for adjacent time periods and repeated measures ANOVA across all three time periods. Facet mapping of changes in the overall profile will also be conducted.

The ratings developed from the LoU interviews are converted to ordinal data for testing of Hypothesis 5 (changes over time) using Wilcoxin's matched-pairs signed-ranks test. Hypotheses 6 data (relationship of LoU

behaviors to home computer availability) are examined using Spearman Rho correlation coefficients. Hypotheses 7 data (relationship of SoCQ attitudes to home computer availability) are examined using ETA correlation coefficients.

Hypothesis 8 will be examined by a path analysis used to track the relative influence of components of the innovation configuration during the first year of adoption. Components to be tracked include (1) access and usage of the classroom computer, (2) participation in the LEISD professional development, (3) home Internet availability, (4) school access to and usage of the Internet, involvement in electronic discourse, (5) beginning SoCQ and LoU profiles, and (6) ending SoCQ and LoU profiles. Strength of influence along vectors will be examined through correlation coefficients.

Qualitative studies are increasing in education. Its advocates believe that depth of understanding of human phenomena is founded on these data. The electronic discourse among teachers will be examined over time. Changes in content themes and value connotations of procedural statements will be charted.

Procedures

1. In August and September, Human Subject Review forms were completed and filed at the University Research office. LEISD administrative approval was obtained at this time. The Principal Investigators (PIs) met with administration in the LEISD central office to plan training schedules and clarify procedures. Installation of technology was delayed and thus limited the study to middle and high schools.
2. In October, the PIs placed the SoCQ on a website for electronic collection of data. Since every teacher will have access in his or her classroom, all data on this measure can be collected anonymously and electronically. The data are imported into the *Statistical Package for the Social Sciences (SPSS)* for analysis of quantitative data.
3. In November, the PIs and GRA explored the NQAS software for the analysis of teacher discourse. SoCQ and LoU concepts are used as a foundation for content analysis but possible patterns were left open for discovery.
4. In December, the PIs and GRA prepared for the January inservice and the first collection of SoCQ data. Plans were made for dissemination at the Society for Information Technology in Teacher Education (SITE) international conference in March in San Antonio.
5. In January, during the University break, the PIs and GRA participated in the teacher inservice, held in Little Elm. Interviews for LoU were conducted. The first set of SoCQ data was collected electronically and first analyses in SPSS were completed. The LoU data was entered into SPSS for analysis. The listserv was established and the collection of teacher electronic discourse data began.
6. In March, the midterm SoCQ data were collected electronically and the GRA completed the second set of interviews for the LoU data. The PIs prepared and presented a progress report for CCPDC personnel, and for the SITE 99 conference. The GRA continues analysis of teacher discourse.
7. In May, GRA completes third set of interviews on LoU. The last set of SoCQ data are collected electronically. The GRA completes data analysis available through SPSS. Qualitative analyses continue through June. PIs plan with LEISD officials for fall inservice and data collection.
8. In June, preliminary findings are offered on the WEB through CCPDC and PI web pages to other CCPDC districts, to professional associations and government agencies.
9. In July, The PIs complete qualitative analysis using the NQAS, and prepare the appropriate research report.
10. In August, PIs and GRA prepare for inservice at LEISD to share first-year results and project research extension to primary and intermediate schools, as they are equipped for the Internet.

Significance

This study has practical value for education practitioners. Importantly, it also promises contributions to the change process literature using technological configuration as the innovation The research values are

bifurcated: (1) an important study of change process with a contemporary technological innovation, and (2) findings from the qualitative study drawn from teacher electronic discourse.

Change facilitators intervene appropriately as levels of concern are revealed to them. Meeting the needs of the professional, like meeting the needs of our students, helps these professionals advance developmentally in their attitudes and behaviors. Both the quantitative and qualitative analyses provide a strong foundation for effective change facilitation to support the professional development process.

The changes in attitudes and behaviors of these LEISD teachers cannot be generalized because it is a census sample, not a random sample from a specified population. However, the changes in attitudes and behaviors of these LEISD teachers are of significant interest to teachers in other small districts. More than one million Texas students are enrolled in such schools in isolated areas. Internet offers these students and their teachers global access to information and colloquy with their peers in near or distant locations. The Texas Woman's University preservice teachers placed in Little Elm ISD gain unique insights into the use of Internet technology and the changes instituted in the use of Internet for curriculum development and delivery.

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Technology and Innovation in Michigan K-12 Schools: Findings from the NextDay Teacher Innovation Grant Research Project

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Project Overview: Introduction to the Michigan NextDay Research Project

Program Goals

1. Identify and share best practices among grantees and other educators in Michigan and beyond
2. Encourage and document sharing and learning among grantees
3. Encourage and support action research of grantees
4. Document and analyze the impact of the grants on teaching practices, learning outcomes, and school culture of technology integration

Overarching Research Questions

1. What impact does the program have on the grantees in terms of technology proficiency, technology integration, attitude, and most importantly teaching practices?
2. What impact does the program have on the learning outcomes of students in the classrooms of the grantees, as a result of the change in teaching practices and introduction of technology?
3. What impact does the program have on the culture of technology integration in the schools/districts of the grantees in terms of changes in other teachers and the school or district?

NextDay Proposals
Research Design

Three Level Design

Level 1: All grantees (115) participate at this level. We will:

- Examine the grant applications submitted by each grantee
- Conduct three surveys among every grantee to inventory their computer attitude, computer use(projected and existing), computer proficiency, self-efficacy, pedagogical beliefs, and teaching practices
- Facilitate and observe electronic communications of participants throughout the year on a list server and on a Web-based forum
- Collect monthly electronic journals throughout the project
- Collect bimonthly panorama pictures of the classroom or a classroom activity and descriptions of the activities

1□

2□ Level 2. Thirty grantees, selected to represent diversity in subject area, grade level, geographical location, technological level, district size and type (urban, suburban, or rural), and student SES, participate at this level. In addition to level 1 data, we will:

- Conduct two face-to-face interviews (one at the beginning and one the end of the project) and three electronic interviews throughout the year

3□

4□ Level 3. Twelve grantees, selected to represent diversity in grade level and subject area, participate at this level. In addition to level 1 and level 2, we will:

- Visit and observe classrooms frequently (once-a-month)
- Interview teachers frequently
- Interview students and parents
- Survey other staff at the school

NextDay Teachers
NextDay Research Team*

To learn more about the NextDay Research project, please visit our website at:
http:// zhao.educ.msu.edu/nextday

Agt-12/08/98

Research to Practice: An Online Connection

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Abstract: The infusion of technology into pre-service teacher education should be a major priority for teacher education programs across the country; especially in the area of special education where technology integration can be beneficial to student development. Similarly, teacher education programs need to prepare students to bridge the gap between teaching and research This presentation describes how we have begun to integrate the Internet and world wide web into pre-service teacher education method instruction in hopes of expanding the instructional use of technology in special education classrooms while integrating best practice (based on effective research) across the curriculum.

The infusion of technology into pre-service teacher education should be a major priority for teacher education programs across the country; especially in the area of special education where technology integration can be beneficial to student development (Carnine, Bean, Miller, & Zigmond, 1994; Hasselbring & Goin, 1991; MacArthur & Malouf, 1990). This presentation will describe how we have begun to integrate technology across the Special Education Methods Block. We have organized the discussion to illustrate various ways faculty members can provide models of appropriate use of computers for instructional purposes. Although not exhaustive, the examples are meant to illustrate ways higher education can prepare both pre- and in-service teachers to integrate the Internet and problem-solving software into their K-12 classroom instruction.

Specifically, we will illustrate how the Internet provides a way to help bridge the gap between teaching and research. We are all familiar with teachers' often justifiable complaint that research is something done and read by professors in ivory towers. This attitude is a response to the difficulty many teachers have in interpreting research methods and results that are written to satisfy the rigorous standards of research journals. Yet, in our own experiences, we have found pre- and in-service teachers to be quite receptive to the idea that research should be used by teachers in their classrooms.

Effective teachers (i.e., those whose students have greater measured outcomes than other students) are researchers, whether they recognize themselves as such or not: They analyze their students' levels of performance; they make instructional changes in response to those levels of performance, and; they evaluate the effects of those instructional changes. Sometimes this is accomplished through the use of pre- and post-tests analogous to studies using statistical procedures to evaluate the effects of interventions; other times it is accomplished through repeated measures of baseline and intervention data analogous to single-subject research methods. One goal we have is to make it more evident to teachers that they can and should be researchers (i.e., prove that the techniques they choose to use are effective) by exercising more deliberate control over their data-collection procedures and instructional decision-making processes. At the same time, we must convince them that they don't need to "reinvent the wheel" or rely solely on other teachers' personal experiences and anecdotes to deal with every behavior and learning problem they encounter. There is existing research with direct classroom applications in libraries, and increasingly in cyberspace, waiting to be found.

This presentation will illustrate how we employ these resources in special education method instruction. We will share with participants examples of a research-based online component that offers teacher-educators access to online research-based resources.

Our specific objectives include:

- Discussion of strategies to incorporate technology across curriculum and methods instruction;
- identify ways faculty members can model the use of technology in teacher education preparation;
- model ways the Internet and multimedia applications can be used to bridge the gap between research and practice; and

- demonstrate how students are currently developing an online research-based resource for special education teachers.

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Learning Schools Programme: Developing Teachers' Information Communication Technology Competence In The Support Of Learning.

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Abstract: The UK government has initiated a massive information communication technology (ICT) staff development programme: LoFTTI (Lottery funded Teacher Training Initiative). The aim of this programme is to train all practicing teachers in state schools within the UK so that they can make effective use of ICT as a tool to support their children's learning. The Learning Schools Programme is one of the consortia that are intending to provide this training. The paper sets out of a brief history of key developments in ICT use in UK schools over the last 25 years and the requirements that have been set down for LoFTTI. The content, structure and support mechanisms for the Learning Schools Programme's training is then described, with reference to relevant literature.

A Brief History - 1970 To 1998

The use of ICT in UK schools goes back over two decades. In the early 1970's the UK government founded the original National Council for Educational Technology that had the brief of evaluating and encouraging the development of educational technology. Since then there have been a large number of centrally driven initiatives relating to the use of ICT in schools. For example, in the early 1980s the Department for Trade and Industry funded schemes to put a computer into every school (in England). At around the same time the Microelectronics in Education Programme was funded to provided a focal point for staff development in the use of ICT in schools and developed a substantial base of support materials. A large number of similar schemes were rolled out over the 80's and 90's.

In 1990 the UK government introduced the National Curriculum for state schools in England and Wales. Information Technology (IT) was included as part of the Technology curriculum. In 1995 a revised National Curriculum was introduced, in which IT appeared as a subject in its own right as well as being included as part of the general requirements for every other subject except PE and RE.

Despite all of these initiatives, and the expenditure of hundreds of millions of pounds on the development of IT in schools, there is considerable evidence that in the majority of schools IT is not being used extensively nor in ways that enhanced children's learning (OFSTED, 1997; Underwood & Monteith, 1998).

McCormick (1992) identified two common failings of these initiatives as being a lack of provision of training and a focus on the level of the classroom rather than the school as a whole. Additional problems, which Maddux (1994 p.130) identified with early schemes in the USA, also apply to the ones in the UK, namely that the Government was mandating the use of technology in schools and that there tended to be an emphasis on computer literacy which suggests that learning about computers per se is the main aim.

When the new Labour government came into power in 1997 a major part of their platform was to increase the level of 'basic skills' achieved by children in the UK. Prior to their election, they had commissioned a report that stated that "if the next government does not take steps to intensify the use of information and communications technology (ICT) in our schools, a generation of children - and a generation of adults as teachers – will have been put at enormous disadvantage with consequences for the UK that will be difficult to reverse." (Stevenson et al., 1997 'Our Vision'). Thus, with the aid of the relevant government departments, they introduced a number of 'educational' initiatives in 1998, including:

- The National Grid for Learning (NGfL), which is a web-based initiative, focussed on education. (See http://www.ngfl.gov.uk/ and DfEE, 1998a).
- Funding to connect every school in the country to the internet and to provide additional computer equipment. This funding now stands at £700Million over the period 1998 to 2002.
- The 'Literacy hour' for schools in England. This requires that all primary aged children spend a minimum of one hour per day studying English and prescribes a detailed English language curriculum and teaching methodology predominantly based around whole class teaching.
- The 'Numeracy Programme', which will be implemented in September 1999. This will involve a detailed maths curriculum and a teaching methodology largely based around whole class teaching.
- A national curriculum for initial teacher training (DfEE, 1998b). This included requirements for ICT, which every trainee teacher has to achieve in order to become a qualified teacher.
- An IT audit, known as 'the Needs Identification', which is due to be carried out by all existing teachers in state schools in the UK early in 1999.
- The Lottery funded Teacher Training Initiative (LoFTTI). (See below)

These initiatives, like many of their predecessors, represent a power-coercive model of curriculum development. They are being imposed on UK teachers by the government at a time when they have already been swamped with centrally imposed changes, many of which have served to de-motivate and de-professionalise teachers.

An Overview Of LoFTTI: The Lottery Funded Teacher Training Initiative

LoFTTI is a £230Million programme to train practicing teachers in UK schools to use information and communications technology (ICT) in their subject teaching, starting in April 1999. This initiative, at least implicitly, recognises that:

- ICT has the potential to enhance learning across the curriculum (Scrimshaw, 1997);
- the majority of schools within the UK are not harnessing the potential of ICT effectively (OFSTED, 1997) or to quote Stevenson et al (1997 Summary) "the state of ICT in our schools is primitive and not improving";
- "Teachers need to know not only how to operate the systems in a technical sense, but also what educational possibilities they have, and the consequences of their introduction both for teaching strategies and for curriculum planning." (Scrimshaw, 1997 para 17);
- incorporating ICT in teachers' professional practice represents a significant innovation (e.g. Hoffman, 1996; Kerr, 1991; Maddux, 1994; Ridgway & Passey, 1995; Somekh & Davis, 1997);
- "innovation involves winning people over to change the way they do things, and this can never be achieved without adequate and appropriate professional development." (Somekh, 1998 p11).

In addition, LoFTTI has recognized that previous attempts to train teachers to use ICT, which have been focused on relatively small numbers of teachers and have often used a cascade model, have not worked. Thus this initiative aims to train every single practicing teacher in state schools in the UK over a three-year period. This represents around 450,000 teachers in England, Scotland, Wales and Northern Ireland. In order to achieve this ambitious target an invitation to tender as an approved training provider was issued in September 1998. This set out in great detail the purposes of the planned training and the outcomes that were expected. These outcomes, which are largely the same in each of the four countries, consist of pages of competencies that teachers should have, both in the use of ICT in the teaching of other subjects and in their knowledge and understanding of ICT itself. The focus of the training is very much on developing teachers' skills in using ICT to support the development of children's learning in other subject areas.

The total training budget of £230 million pounds, which amounts to approximately £460 per teacher, will be devolved to schools in the form of vouchers that can only be used to buy ICT training from approved providers. The approved training providers will thus operate in a competitive market in which schools can choose which provider to use (with variations across the four countries about the role that their local educational authorities will play in the process of selecting providers).

The Learning Schools Programme

The Learning Schools Programme is being developed by a consortium of organisations, who together applied to become an approved training provider. The consortium consists of a partnership between the Open University (OU) and Research Machines (RM), plus associate organisations including Education Authorities employing approximately 320,000 teachers across the UK as well as other professional bodies, organisations and individuals. The OU provide expertise in relevant curriculum and research areas as well as in the development of effective supported self-study materials. RM is one of the most significant suppliers of ICT equipment and services to UK education and provides extensive support networks and excellent links with schools and education authorities across the UK.

The Learning Schools Programme (LSP) will provide staff development across all four countries in the UK. There is one core course for primary school teachers (K-6), which focuses on the use of ICT in literacy, numeracy, science, and cross-curricular work. This will be supplemented by additional material for use in Northern Ireland and in English speaking schools in Wales, as well as a version of the course with material originated in Wales and presented in Welsh. There are 14 core courses for secondary school teachers (for students aged 11-16), each focused on the use of ICT in supporting teaching in one of the national curriculum subjects (e.g. English, Maths, Science, History, etc.). In Wales, the Welsh language as a subject will also have specifically produced material. Thus we are combining a generic cross-country approach with a country-specific one. In addition, all the courses are linked into a UK wide accreditation framework, which contributes towards postgraduate qualifications such as a Masters in Education.

The Learning Schools Programme is adopting a *school based, supported self-study* model of staff development that is based on a *constructivist* view of learning. This has a number of implications for the 'courses', which are discussed below.

A School Based Approach

Being school based is crucial because the conditions and factors that impede professional development of teachers who need to learn skills for teaching with technology reside in the culture of the school (Barnes & Hall, 1998). A culture change is needed for schools to become learning organizations in which teachers see their own learning as part of their professional role (Lieberman, 1995). As we noted earlier, the school needs to be the focus for professional development, allowing a balancing of the needs of individuals and institutions. The importance of leadership in any change effort is widely recognised (e.g. Barnes & Hall, 1998; Fullan, 1986; Hoffman, 1996; Hopkins & al, 1994; Lieberman & Miller, 1990; Louis & Miles, 1990; Miles, Saxl, & Lieberman, 1988). Part of the reason for the importance of leadership is the key role that 'leaders' play in providing pressure and support for any given initiative. Pressure and support are both necessary for the successful implementation of change in education (Fullan & Stiegelbauer, 1991, p. 91) and a key element of this is an "expectation from the institution that effective educational technology be used" (Topp et al., 1996, p. 58).

There are also more practical issues relating to basing training on the resources available within the school. Taking teachers out to special centres has limited effectiveness, not only in exposing them to equipment that is not available in school, but also assuming a cascade of change from these teachers to those who remain in school. Thus the LSP courses will include materials for a *school organiser* as well as external support for them (see *A supported approach* below). The programme is intended to link in closely with school development plans, and the school materials reflect this, as well as including elements to assist with the administration of the Programme. The need to include the whole school community is recognised through the provision of materials (e.g. videos) aimed at parents, governors, staff and children. A communal library of books about the management of change and ICT use in schools is also provided within the school-level materials.

In recognition of the importance of access to equipment (e.g. Topp et al., 1996; Twining, 1998) the LSP had intended to provide portable computers as part of the school-level materials. However, the rules governing LoFFTI funding did not permit funding to provide any hardware.

A Supported Self-study Approach

There is a great deal of evidence that one of the most important ways in which teachers develop their ability to use ICT in their teaching is through time spent at home (e.g. Hoffman, 1996; Stevenson et al., 1997). Adopting a self-study approach also provides greater flexibility for teachers in that they have more freedom to work on the programme when and where they wish than would be the case with other modes of study. However, the importance of support for a significant staff development programme at a range of levels is crucial (e.g. Hoffman, 1996; Fullan & Stiegelbauer, 1991). Within the LSP support is provided at all levels and in a number of different ways. Thus school organisers and teachers working on the programme are provided with:

- structured course materials using a range of media (e.g. paper, multi-media and the Internet);
- in-school support from peers, their school organiser and their regional advisor in the form of face-to-face meetings and computer-mediated communication (email and conferences);
- access to the National Grid for Learning (NGfL), which contains extensive support material for teachers provided by other organisations as well as access to teacher discussion forae;
- technical support in the form of a telephone help line operated by Research Machines.

In addition the regional advisors, who support staff in schools, are provided with face-to-face training as well as electronic support conferences designed specifically for them and moderated by staff at the Open University.

A Constructivist Approach

The LSP is in full agreement with Lieberman (1995) when she says that staff development cannot be thought of as bite-sized packages of knowledge to be transferred to teachers. Thus, though we are providing materials that encapsulate 'bite-sized packages of knowledge' we see it as being crucial that these are contextualised and debated locally by individual teachers. We believe that if they are going to "really change the way they work - then teachers must have opportunities to discuss, think about, try out, and hone new practices. This means that they must be involved in learning about, developing, and using new ideas with their students." (Lieberman, 1995 p.593). Thus LSP encourages teachers to:

- engage with resources that encapsulate models of teaching using ICT and raise issues about the implications of such practice;
- enter into an iterative process of planning, implementing and evaluating activities that are relevant to their own contexts, incorporating ICT where appropriate;
- act as reflective practitioners (Schon, 1987) and share their experiences with colleagues.

A Long Term Approach

There is substantial evidence that indicates that any programme that aims to integrate ICT in teachers' practices requires a long time frame (e.g. Hoffman, 1996; Ridgway & Passey, 1995 p67; Somekh, 1998; Topp et al., 1996). Thus the LSP allows teachers to work on the programme over a period of up to six months and provides continuation mechanisms and strategies to support teachers after the end of their formal enrollment on the programme. The Programme is built round an action plan supported by a professional development record, which we hope will continue after the initial training is completed. Indeed, the possibility of continuing electronic conferences and access to the internet, should encourage teachers to move from a focus on ICT as the subject of their professional development, to ICT a means of their development across the range of professional issues.

A Subject Oriented, Problem Solving Focus

Throughout the programme our approach focuses on the real issues facing teachers who are trying to teach their subject(s), in line with the suggestion that the best way forward is to "drop all consideration of increasing the use of technology for technology's sake and approach change from the perspective of developing solutions to problems." (Willis & Robinson, 1994 p.15). This approach also recognises and builds upon the expertise of

teachers rather then adopting a deficit model (Rhodes, 1989). We hold a strong belief that ICT is an effective tool for education and agree with Willis that in these circumstances "a problem-focused change effort will include {new technologies} as an element of solutions even though technology was not an initial target." (Willis & Robinson, 1994 p15). This needs to be combined with activities and outcomes of the programme that are seen as being of practical value by the teachers concerned (Somekh, 1998). Hence, we have aimed to follow Ridgway and Passey's advice that: "Early stages should focus on achieving desirable goals which are hard to reach in other ways (such as supporting problem solving groups, developing writing skills, inculcating modeling skills), while providing positive classroom experiences for teachers and students. These stages should be attainable without a massive investment of time by the teacher. They should lead onto pleasant classroom experiences, which actually make teaching easier, and the educational gains by students should be judged to be valuable by the students themselves, by other teachers, by parents, and by people outside the school community." (Ridgway & Passey, 1995 p.66).

A Differentiated Approach

The LSP aims to cater for a large number of teachers, covering a broad spectrum of levels of confidence and competence in their own personal use of ICT as well as in its use within teaching. Thus differentiation is a key issue for us. Indeed, it is important that we build on the individual outcomes that teachers have achieved from their 'Needs Identification' audit (see under *A Brief History* above) both politically and because "innovations are likely to fail when they challenge fundamental values and practices, ... ignore the starting points of the individuals involved, fail to monitor progress, and adapt the programme appropriately" (Ridgway & Passey, 1995 p.66). We aim to achieve differentiation by providing a range of starting points and end points with clearly defined routes between them. However, we have utilised some of the flexibility that electronic media provide to allow teachers to fit the material to their own needs and interests.

Summary

The LSP has been developed in the light of past research into staff development and the implementation of ICT in schools. It is adopting a *school based*, *supported self-study* model of staff development that is based on a constructivist view of learning. However, despite the fact that the LoFTTI initiative clearly reflects the recommendations made in the synoptic report on the evaluations of the Education Departments Superhighways Initiative (Scrimshaw, 1997), there is inevitably a tension between any centrally imposed innovation and the approach to staff development that the Learning Schools Programme aims to adopt. For example, whilst the Learning Schools Programme aims to empower teachers to use new technologies in ways that serve their own needs, the need to use ICT to enhance their teaching is being imposed upon them. Similarly, the LSP's aim is to build on the expertise that teachers have and yet LoFTTI takes as its starting point the Needs Identification, which will have identified the areas where teachers lack necessary skills. The extent to which we have succeeded in reconciling these tensions and the degree of effectiveness of our approach remain open questions; the first teachers are due to start working on the LSP in April!

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The Role of Technology in School Improvement and Comprehensive School Reform

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Abstract: This paper is a report combines the findings of a study conducted on how, three North Carolina school districts created a representative consortium of rural schools to construct methods to identify when and how technology impacts school reform and the changes necessary if technology is to impact education reform efforts. The Technology Activity Gage or TAG instrument is being piloted to identify how technology is used in schools. The TAG instrument can be used in a similar fashion as thee CEO Forum's 1997 School Technology and Readiness (StaR) Chart. This approach incorporates prior research on technology implementation conducted on the Rural Technology Challenge Partnership, with emphasized professional growth of teachers, students exposure and development of technology skills, and accountability to all involved.

Introduction

Beginning in 1998, three North Carolina school districts created a representative consortium of rural schools to construct methods to identify when and how technology impacts school reform. Currently this endeavor is being accomplished through program evaluation and the use of the Technology Activity Gauge instrument. The Technology Activity Gauge, or TAG, is based on Cronbach's (1983) functional model of design, which states that each school, even within the same district, differs in the areas of political, social, and resource structures, and helps us to understand why technology focused models of school reform fail to be replicated from school to school successfully. TAG's technical approach is based on establishing uniformed instrumentation to identify three levels of technology-use indicators and student-learning indicators. Reported indicator levels reveal a classroom's TAG level. TAG levels consist of low (1), medium (2), high (3), or target tech (4). The TAG instrument can be used in a similar fashion as thee CEO Forum's 1997 School Technology and Readiness (StaR) Chart. This approach incorporates professional growth of teachers, students exposure and development of technology skills, and accountability to all involved.

Two types of technology indicator levels are associated with school reform. TAG incorporates both Indicators of Use and Indicators of Learning Activities. Means (1994) argues that technology can support exactly the kinds of changes in content, roles, organizational climate, and activities that are the center of the education reform movement. It is the goal of indicators of use to determine how often and in what ways technology is utilized in the school

Whether technology and education begin to develop a partnership in the reconstruction of conventional education will depend on whether or not educators develop and sustain a set of instructional goals that promote learning, and then find appropriate ways to use technology as a tool to achieve those goals. Technology must no longer be viewed as a goal to be achieved in and of itself, but instead a support for the learning process (Sheingold & Tucker, 1990).

Teachers who use technology in the classroom do so because they believe it will support more complex and challenging forms of learning. The reform efforts of the past have taught us that to improve the quality of instruction requires the transformation of learning environments into those that are conducive to learning. Educators and psychologists agree that in order for students to achieve higher order thinking skills we must shift from our paradigm that focuses on the transmission of information and skills through listening, to a paradigm that considers learning to be a participatory process where students construct knowledge through experiences, inquiry, and a variety of other resources. Table 1 illustrates the changes that must occur for this constructivist paradigm to become the guiding force in our schools (Roehrig Knapp & Glenn, 1996).

The introduction of technology has the potential to promote the changes that are necessary for school restructuring. First, technology encourages the recognition that learning is a lifelong process. Because technology continues to rapidly change teachers realize that they must constantly evaluate and manipulate information. Second, technology promotes collegiality between teachers. Because technology is new to many teachers it becomes necessary that they interact and exchange information regarding its use to promote teaching and learning. Third, technology provides teachers and students opportunities to engage in problem solving activities, and lastly technology changes the roles and relationships in the classroom by distributing expert knowledge throughout the classroom among teachers and students. This changes the role of the teacher from that of "keeper of knowledge" to that of a facilitator of learning (David, 1991).

Changes Necessary to Restructure Education

Element of Change	Conventional School Characteristics	Restructured School Characteristics
Learning	Students learn by absorbing information and skills through listening, lecturing and textbooks.	Students learn by constructing knowledge through inquiry and experience.
Teaching	Teachers introduce information and skills, and then assign exercises to encourage the memorization of the content.	Teachers engage students in activities that promote critical thinking, problem solving and the development of questions. Teachers are facilitators, coaches and a resource.
Curriculum	Emphasizes the mastery of skills through a curriculum divided by content area and ability level.	Emphasis is on inquiry designed to engage students in solving real problems that are interdisciplinary.
Classrooms	Isolated settings that are teacher centered. School work is typically individual and competitive.	Multipurpose rooms where school activity is collaborative and focused on cooperation and team building.
Assessment	Focused on short answer and essay tests that demand the simple recall of facts and fragmented pieces of information.	Focused on the ability of the students to demonstrate their knowledge and skills. Students are allowed to self assess. The purpose of assessment is to allow for continued improvement and more complex learning.
Technology	Traditionally have included pencils, paper, chalkboards, textbooks, manipulatives and other resources that help develop basic skills.	Variety of tools to create knowledge and skills by supporting research, analysis, problem-solving, and communication.

Table 1: changes that must occur for this constructivist paradigm to become the guiding force in our schools' technology implementation (Roehrig Knapp & Glenn, 1996).

Means and Olson (1993) in their study of school reform and technology literature identified that technology: stimulates teachers to engage students in more complex tasks and materials; provides teachers a context to become learners, and to share their ideas about curriculum and instruction; motivates students to engage in more complex tasks, and to focus more on the quality of their work; while allowing them to solve problems in ways that adults do in the real world. As teachers gain access to the use of technology in the classroom it can often be overwhelming for them. Often they question what role technology will play in their classroom, what professional implications are involved in using technology, how technology will

impact student learning, and how they will integrate technology in all content areas (Roehrig Knapp & Glenn, 1996). The first question teachers ask is what role technology will play in their classroom? The TAG intitative addresses this question by providing teachers professional development both in and out of the classroom. Teachers receive technology instruction and work collaboratively with The Center for Technology Education & Assessment staff to develop ways to use technology in developmentally appropriate ways that promote learning. . The second question teachers ask is what implications technology will have on them professionally? Means and Olson, 1993; Cotton, 1991; Bialo and Sivin, 1990; and Sheingold and Hadley, 1990 all suggest that using technology effectively in the classroom will enable teachers to be more successful in meeting the needs of their students. Teachers who instruct with technology: have higher expectations for student work, engage students in more complex and challenging activities, are able to meet individual needs of students, are more innovative in instructional practices, and experience a greater sense of professionalism about their role as a facilitator in the learning process

As the importance of technology increases in U.S. schools educators must focus on creating environments that promote its effective use. Sheingold and Hadley (1990), and Means and Olson (1993) have identified characteristics of a technologically favorable teaching and learning environments. The essentials include; access to use technology when and where it is needed in instruction; teachers must be experienced in how to use the technology; support must be provided to teachers; school administration must support instructional practices that differ from traditional approaches.

The School Technology and Readiness (STAR,1997) report shows how far our schools are from creating the best environment for technology to become a key factor in the restructuring of education. STAR profiled schools current use of technology , and categorized them according to their hardware capabilities, connectivity, content, and professional development activities. Their findings indicate that 59 percent of American schools have either no technology or poor, inadequate technology for their students. There were less than 3 percent of schools who were considered on the high level cutting edge of technology integration. The first category, low technology schools typically have limited access to modern computer technology, and limited access to computer networks. Fifty nine (59%) percent of American schools fall in the low technology category. The second category, mid technology schools, have moderate access to modern computer technology, and computer networks. This category contains 26 percent of schools. Only 12 percent of schools were placed in the third category, high technology schools, characterized as having significant access to modern computer technology, and networks. The last category, target technology schools, included only 3 percent of American schools. This category boasts the highest level of computer technology and network access for students with typical ratios of 3 students per computer, and 4 per multimedia computer.

The President's Committee of Advisors on Science and Technology (PCAST, 1997) also highlighted concerns about access, but more importantly focused on how technology could most effectively be used to enhance learning. This report recognizes that in order for technology to maximize it's potential in improving teaching and learning, a shift must occur in the view of technology as a tool to more efficiently perform traditional instructional practices, to a constructivist view or paradigm that views technology as a tool to sustain a classroom . In the constructivist paradigm the teacher's role becomes that of a facilitator in the learning process and students are helped to construct knowledge through interaction, and experiences. The notion of "teacher as expert" is no longer the guiding philosophy of the classroom environment. PCAST (1997) represents a national perspective recognizing the importance of a constructivist model to enhance the teaching and learning that occurs in American schools.

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Professional Development for Transformative Teaching with Technology in K-8 Classrooms

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"Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other and we need them all." -Arthur C. Clarke

Abstract: This study was conducted to examine the impact of an intensive professional development program on teachers' growth as educators. The researchers analyzed teachers' reflections on their attempts to integrate technology into their teaching and teachers' perceptions of their growth at the conclusion of the three-year project. In this study, echoing Clarke's viewpoint, the researchers investigated teachers' understandings of their journey and transformations in teaching, rather than multimedia hardware and software, per se.

Background

Research shows that successful professional development takes place over an extended period of time (Fullan 1991). Additionally, it provides for distributed learning/implementation to foster systemic change (Fullan 1991). Male (1994) suggests that successful classroom implementation of practices provided in professional development requires: theory, demonstrations of appropriate uses, opportunities for immediate practice and feedback, time to adapt curricula to technology, coaching, and periodic review. In a recent study, Cleland, Zambo, Wetzel, Buss, and Rillero (in press) reported on a successful professional development featuring (a) modeling of pedagogical strategies, (b) providing time for participants to implement their new understandings, and (c) providing opportunities for reflection.

Well-designed preservice teacher preparation programs and inservice professional development programs should provide opportunities for individuals to reflect on their teaching. Reflective teaching, critical evaluation and review of teaching for the purpose of improving practice, has played a prominent role in teaching and teacher education programs since its advent in the early 1980s. For example, since Schon's (1983) seminal work on reflective teaching practice, entire teacher education programs have been designed around this concept. Subsequent work by Schon (1987, 1991), Peterson and Comeaux (1989), and others attests to the richness of the reflection process. As a result, pre-service teachers are frequently asked to engage in systematic, reflective practice during their pre-service preparation through specific course requirements such as journaling, "reflection papers," and so on.

Although practicing teachers also engage in reflective practice, albeit on an intuitive, non-systematic basis, much less is known about the effect of reflection on the daily teaching of in-service teachers. Nevertheless, Cranton (1996) cogently argues that reflection is fundamental to the professional development of educators. In particular, Cranton (1996, p. 76) notes, "If educators are to develop their practice, a process including both personal and professional growth, then critical reflection on practice will be central to learning. ... [further] *development* requires moving beyond the acquisition of new

knowledge and understanding, into questioning our existing assumptions, values, and perspectives." It is clear that new knowledge such as that acquired during "professional training" can provide "grist for the reflective mill." Moreover, when teachers are confronted with how to apply this new knowledge (e.g., technology to aid science instruction) to their classrooms, they must stop to consider how this information can be incorporated into already existing instructional units, materials, and activities, and/or how they might change their teaching.

Such critical reflection can lead to transformations in teaching practice, what Cranton (1996) calls transformative learning. Transformative learning occurs when there is a revision of basic assumptions, beliefs, or perspectives. Thus, for example, when a teacher revises her teaching perspective to incorporate a problem solving orientation rather than merely teaching an array of isolated algorithms in mathematics, she demonstrates transformative learning.

Project Overview

In this paper, we report the progress of 54 teachers who participated in a collaborative College of Education/Southwestern school district staff development program funded by a National Eisenhower Grant. Teachers from two elementary schools participated in three years of after-school workshops as well as extended summer sessions.

The goals of the project for participants were: (a) to develop teachers' technological skills to use applications for production, presentation, and telecommunications; (b) to develop teachers' pedagogical strategies; (c) to develop content-rich, real-world thematic units that focus on mathematics and science using the tools of technology; and (d) to apply technological and pedagogical skills from the professional development workshops to classroom situations. An additional goal was that participants' student would develop skills for using the applications listed above as part of their daily classroom activities as teachers implemented the new instructional strategies. It was anticipated that in working toward these goals teachers would change the nature of their instruction.

To effect a change in the instructional culture of a school is no simple task. To help make technology integration a topic of daily discussions among teachers as they implemented new instructional materials and strategies, several elements of effective professional development were incorporated into the design of the program.

Specific schools were targeted over the three years of the project to achieve a high teacher participation rate at each site. This concentration of participants at two sites encouraged teamwork and collaboration between teacher participants.

Teachers were given incentives to fully participate in the workshop activities. The incentives included stipends, computer equipment for their classrooms, and the opportunity to earn university graduate credit.

The project incorporated an extended format of instruction over a 10-month period each year. Weekly school-year workshops focusing on the learning of new material were coupled with intensive summer workshops during which teachers could consolidate their learning and apply it to the production of integrated units/lessons. During the instructional segments of the workshops, leaders modeled pedagogical strategies that were to be incorporated by teachers into their classroom instruction. Teachers were able to implement the newly learned material in their classrooms between workshop sessions.

The project provided extensive opportunities for teacher reflection. During each workshop session teachers discussed orally the successes and challenges they had encountered during the school week as they attempted to test strategies and materials they had learned about in the workshops. At the end of each

workshop session, teachers were encouraged to reflect on what they had learned during the session and how they might use the newly acquired in their classrooms over the following week.

In addition to the reflective opportunities that were a part of each workshop. Teachers also maintained a written journal between workshop sessions. This allowed teachers to record their endeavors in a timely manner, as well as encouraging them to reflect about their teaching with technology on a daily basis.

Data Sources and Data Analysis

To describe the project teachers' growth as educators during this professional development program, data were collected from multiple sources: participants' weekly journal entries, weekly workshop feedback forms, and open-ended questions answered at the completion of the three-year program. As the researchers read and re-read journal entries, workshop feedback and final responses, categories emerged. The data were then coded using these emergent categories: teachers' struggles, technology-using teacher, integration of technology in the classroom, transformations in teaching, and emphasis on higher level thinking skills. As the study progressed, related categories were merged to facilitate interpretation and reporting.

Findings

Teachers' Struggles

As teachers attempted to implement new classroom projects in which students used technological tools, they were working out the answer to: "How do I teach with technology in my classroom?" Examples of their concerns included:

- "Kids worked in groups to create a stack based on what they found on their insects. Each child did a page. This is a slow process. How do other teachers utilize their time on the computers?" Sue, 4th grade teacher

- "Internet exploration with a group during class doesn't work because it takes too much of my time while the other groups need attention too." Mary, 5th grade teacher

- "Am I guiding too much when I anticipate possible stumbling blocks? I don't want to give them answers, but I also don't want them to become sidetracked or distracted on unnecessary problems that will discourage them." Jen, 7th/8th grade science teacher

Sue and Mary express concerns about organizing students to use one or two computer stations in the classroom, managing such a new arrangement, and noticing that students are working slowly and taking too much of their time. Jen voices her concern about the appropriate amount of scaffolding to provide for students attempting to solve problems using technology tools.

Every week participants discussed many different issues and problems. Through the workshop discussions, trainer modeling of lessons, and reflections on practice, teachers began to work out their own unique solutions to their quandaries. The mix of new information, social support, and time for individual reflection enabled teachers to try new ideas and technologies in their classrooms, question practice, deal with obstacles, and grow.

Teachers' Growth as Educators

The researchers asked the participants to describe their growth over the course of the three-year staff development program.

Technology-integrating Teachers

The project leaders noticed that participants became more comfortable with the integration of technology in the classroom as a result of sustained opportunities to learn, practice and reflect. For example, teachers said,

- "I feel perfectly competent and at ease with computers and technology in the classroom . . . I use technology as a standard and it is integrated into the curriculum." Tim, 7th grade teacher

- "One thing I would like to point out . . . teaching us to learn to work out the problems has been such a great idea. We have to learn to troubleshoot for ourselves and I think this has been one the reasons I feel that the program is a success. I have learned, through the help of the trainers, how to handle many of the situations that come my way, on a daily basis." Kelly, 8th grade teacher

- "I am especially proud that I could use this technology in a Kindergarten classroom. I am able to have students create books, reports, and projects using the technology. I was a little concerned about how I was going to use the technology that was given to me. Frankly, (now) I need more!!!!!" Nancy, kindergarten teacher

- "I am currently involved with the National Geographic Society working on "What's in Our Water? as a test site. Because of my experience I feel I am better able to deal with this project." Margarita, 4th grade teacher

We believe that the professional development program encouraged teachers to address problems encountered by writing about the problems and articulating the specific concerns, making connections between the modeling provided by the leaders of the workshops and their classrooms, and orally sharing problems and solutions as part of the workshop format.

Transformative teaching

During the project a number of teachers transformed their teaching from didactic, whole group instruction to project based learning with cooperative groups, hands-on projects, and student presentations. Such transformative teaching is exhibited in individual teacher's stories that follow.

- "I have made many changes in my teaching over the past three years. When I am writing my lesson plans or working on a unit, I think about how the computer will fit in. I don't just limit the use of the computer to free time or if the students have their work done. I encourage them to work together to solve (problems) and to use the (student) computer "experts" in the classroom." Jorge, 6th grade teacher

- "I recently interviewed for a job at another school. One of the questions I asked was what technology they could offer me at their school. When I was told that what they could offer me was a jack in the wall for a phone line, I honestly had less enthusiasm for working there! I felt an incredible loss not having my Mac, TV/VCR/laserdiscs player, all my software . . . So, in answer to your question, as an educator, I have come to EXPECT technology to be used in my classroom to do everything, when before, it was something that only the teacher used to word process notes going home to parents." Kathy, kindergarten teacher

- "I see a greater need to teach kids problem solving in math. I used to do a lot of computational math and not a lot of higher level thinking. I am now using more problem solving and weaving in computation as necessary. I enjoy using some of the (technology) programs we have in both science and math." Lisa, 4th grade teacher

Discussion

Our analysis suggests participants entered the project with different teaching styles and levels of technology literacy. Because they had diverse backgrounds, their reflections revealed differing amounts of changes in confidence with technology use, integration of technology in the classroom, and teaching style.

During the course of this intensive professional development, some teachers initially doubted the value of technology integration and related teaching practices. Later, as teachers became more comfortable with using technology, they reflected on their own teaching practices. This questioning process was facilitated by providing opportunities for reflection including: (a) discussion of successes and challenges of their own attempts at technology implementation, (b) reflection on training sessions, and (c) written journals maintained between workshop sessions.

In conclusion, for transformative teaching to occur, professional development programs must provide substantial and systematic opportunities for reflection. These practices must be sustained over a period of years. Further, teachers must receive encouragement to try out new practices, discuss them with leaders and colleagues, adapt lessons based on work with students, and reflect on their attempts in relation to their own teaching practices.

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Technological Diffusion within Educational Institutions: Applying the Technology Acceptance Model

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Abstract. Expectancy models of behavior such as the Theory of Reasoned Action and the Technology Acceptance Model offer guidelines that aid efforts to facilitate use of new technology. These models remind us that both acceptance of and resistance to technology use are grounded in beliefs and norms regarding the technology. Although the Technology Acceptance Model is widely used to model user acceptance of technology, we suggest that the model fails to capture all of the relevant components to technology acceptance in the context of educational organizations. This paper discusses the application of expectancy models to educational institutions and we identify relevant aspects of technology use that are accounted for by the Theory of Reasoned Action.

Introduction

When technology offers improvements over existing processes it seems reasonable to expect that the improvements will be readily embraced and incorporated into practice. However, adapting to new technology is rarely this simple; some users will resist change entirely, and even among users who embrace change, the new technology may not be used to its full potential.

Resistance to change is a widely recognized problem in the study of organizations. Resistance is manifested in two behavioral outcomes: either the user fails to incorporate educational technology altogether, or the user fails to use the technology to its full potential (Markus, 1984). The causes of resistance are cognitively based. Because resistance depends partly on the individual's openness to learning and change (Diamond, 1993), we might expect that educators (experts in learning) might be more receptive. However, recent experience with new instructional technology suggests that change in educational organizations is as problematic as change in any other organization.

Five years ago, a deliberate decision was made at the University of Arizona to position a group of early technology adopters as "change agents" on campus. A large interdisciplinary group of faculty recruited by the Provost as a "Faculty Development Team" was assigned the task of preparing the faculty for the use of new technology in the classroom. Specifically, the Team's job was to define training and technology requirements for "student-centered" teaching. Later, this task was handed off to a consortium of instructional support units (the Faculty Development Partnership, formed as a coordinating body for the Library, the Computer Center, the Teaching Center and other units), taking new learning technologies as a defining element of its membership and mission:

> The primary mission of the Faculty Development Partnership is to enhance the undergraduate learning experience at the University of Arizona. Strategically, the Partnership promotes employment of successful teaching models facilitated and strengthened by new learning technologies. Tactically, the Partnership works closely with faculty across the curriculum to create General Education and advanced courses through which students acquire foundational as well as lifelong skills. The Faculty Development Partnership assists campus improvement initiatives, actively supporting ongoing classroom renovations while preparing to implement an Integrated Learning Center (http://www.facpartner.arizona.edu/partners.htm).

Given the specific intention of promoting the use of new technology, and the underlying assumption that new technology will be understood as an enhancement of instruction, the Faculty Development Team and Partnership have undertaken a variety of initiatives to support faculty in technology adoption. At Arizona as at many other educational institutions, two main strategies have been used consistently: incentives and training. These programs have been effective in stimulating some creative projects, but many faculty remain reluctant to consider

the use of new technology and largely unacquainted with its applications to education. State-of-the-art equipment in newly renovated classrooms remains unused, and rich resources for technology-enhanced learning remain underexploited.

For both practical and theoretical reasons it is important to understand resistance to change within educational organizations, and in particular to understand why educators are reluctant to adopt technology advances. The purpose of this paper is to explore theoretical perspectives on technology adoption and to apply those perspectives to common strategies for promoting change.

Reasoned Action Models for Technology Acceptance in Education

One theory with potential utility is the Theory of Reasoned Action (Fishbein & Ajzen, 1975), which has recently been elaborated as a Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989). The basic idea behind the Theory of Reasoned Action (TRA) is that people take the practical and social consequences of action into account in deciding what to do, building an overall "behavioral intention" as a complex function of value-bearing beliefs about the outcome of the behavior and the beliefs about others' evaluations of the behavior.

TRA predicts acceptance or rejection of certain behaviors from attitude and normative influences on the intent to perform those behaviors. A person's attitude toward the behavior is assumed to be made up of beliefs about its outcomes and evaluations attached to those outcomes. Attitude toward the behavior may be strongly positive or strongly negative; however, attitude toward the behavior is only one potential determinant of the behavioral intention. People also take into account a "subjective norm" made up of beliefs about how others important to them will evaluate the behavior and motivations to comply or not with others' influence. According to TRA, intentions are formed as weighted combinations of attitude and subjective norm, and behavior depends most directly on intention.

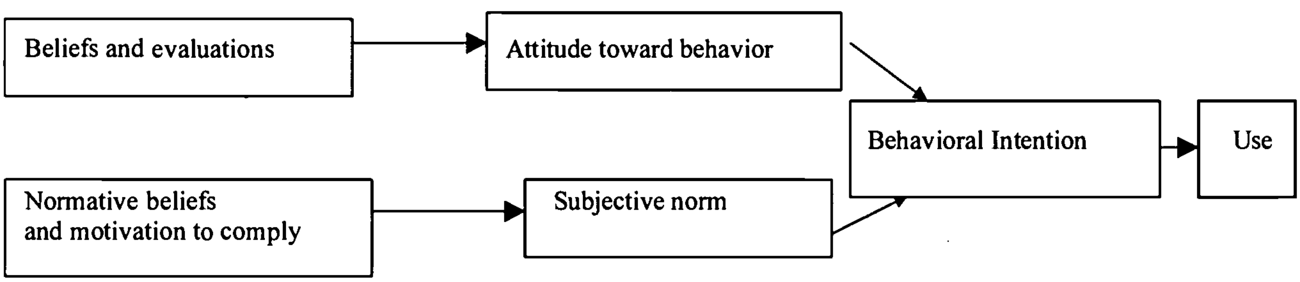

Figure A: Theory of Reasoned Action

The Technology Acceptance Model (TAM) is a specialized adaptation of TRA to technology implementation contexts. This model is used to describe the antecedents to technology use (Davis, et al., 1989). TAM suggests that both technology acceptance and technology resistance are forms of reasoned action, and both are in some sense rational for users. A central theoretical assumption is that technological resistance depends on end-user perceptions (that is, on faculty perceptions in the case of educational organizations). TAM describes the relationship between users' beliefs about technology and their "behavioral intentions" (what they actually intend to do with or without the technology).

The specialization of TRA to the technology acceptance context results in two special features of TAM. First, TAM omits the subjective norm component that, in TRA, combines with attitude to determine intention. The development of TAM as an explanatory model led Davis et al. To an empirically-grounded judgment that technology acceptance does not depend on normative beliefs. Second, TAM centers on two specific beliefs that have been shown to influence acceptance of or resistance to technology: perceived usefulness and perceived ease of use. According to TAM, the likelihood of technology use is high for users who believe that it will lead to improved job performance and who believe that it is easy to use, but low for users who either doubt its benefits or perceive it as difficult.

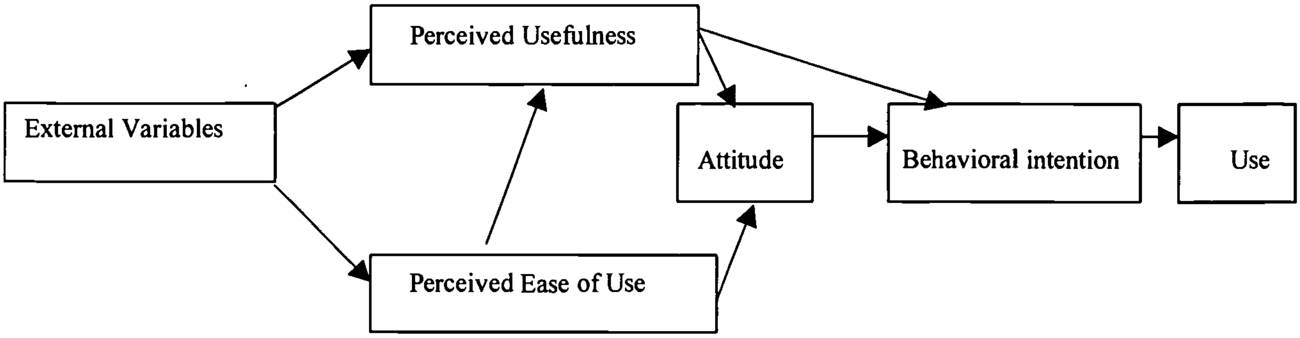

Figure B: Technology Acceptance Model

Although specifically tailored to explaining technology acceptance, TAM may or may not adequately represent the factors affecting technology acceptance in educational contexts. Omission of the subjective norm component seems reasonable enough in some organizational contexts (e.g., for-profit corporations). However, in educational contexts, where technology is a potential influence on teacher/student relationships and where individuals identify themselves closely with expert communities of fellow practitioners, it does not seem plausible to assume that the decision to use technology is made without reference to others' approval or disapproval of its use.

Moreover, the two specific beliefs identified by Davis et al. do not offer a straightforward fit with the practical circumstances of faculty workload. At a minimum, the underlying belief set needs expansion to take account of the common faculty problem of balancing investment of time between two or more budgeted activities (teaching, research, and other duties). While faculty undoubtedly consider the impact on the quality of teaching in deciding whether to adopt new technology, they also consider how investment in teaching improvement affects the overall balance of success they might have in teaching and research. Particularly in Research I universities like Arizona, the rewards for improved teaching are thought to be much less certain and much less tangible than the rewards gained from conducting research.

In the tradition of theoretical and practical research following from TRA, the underlying belief set and the weighting applied to various components is generated empirically. Because we doubt the generalizability of TAM to educational organizations, our own attempts to model faculty acceptance of technology include measurement of a much broader set of potentially relevant beliefs, including normative beliefs, as shown in the survey below (http://emma.comm.arizona.edu/techuse.html).

Strongly Agree = SA Agree = A Neither Agree nor Disagree = N Disagree = D Strongly Disagree = SD

Learning to use WEB based instruction would be difficult for me.	SA	A	N	D	SD
It is easy for me to become skillful at using WEB based instruction.	SA	A	N	D	SD
I find WEB based instruction difficult to use.	SA	A	N	D	SD
Using WEB based instruction demands too much time for the benefit it reaps.	SA	A	N	D	SD
Using WEB based instruction would not improve my teaching performance.	SA	A	N	D	SD
Using WEB based instruction would not increase my productivity.	SA	A	N	D	SD
Using WEB based instruction would enhance my effectiveness as a teacher.	SA	A	N	D	SD
I would find WEB based instruction useful to use in my class.	SA	A	N	D	SD
I intend to increase my use of WEB based instruction in the future.	SA	A	N	D	SD
I don't intend to use WEB based instruction now or in the future.	SA	A	N	D	SD
I intend to use WEB based instruction for teaching.	SA	A	N	D	SD

My use of WEB based instruction is

Good	___	___	___	___	___	Bad
Harmful	___	___	___	___	___	Beneficial
Pleasant	___	___	___	___	___	Unpleasant
Enjoyable	___	___	___	___	___	Not enjoyable
Unnecessary	___	___	___	___	___	Essential
Required	___	___	___	___	___	Optional

Using WEB based instruction is

Unlikely	___	___	___	___	___	Likely
Probable	___	___	___	___	___	Improbable

My students think I	Should	___	___	___	___	___	Should not	Use WEB based instruction.
Most of my peers think I	Should	___	___	___	___	___	Should not	Use WEB based instruction.

I believe that Using WEB based instruction is

Good	___	___	___	___	___	Bad
Harmful	___	___	___	___	___	Beneficial
Undesirable	___	___	___	___	___	Desirable

In terms of using WEB based instruction, how much do you want to do what your peers think you should do?

Not at all ___ ___ ___ ___ ___ Very much

In terms of using WEB based instruction, how much do you want to do what your students think you should do?

Not at all ___ ___ ___ ___ ___ Very much

I currently use WEB based instruction:

Every day	____	Once a month	____	
Every week	____	Not at all	____	
Twice a month	____		____	(fill in)

Figure C: Technology Acceptance Measures

Designing Strategies for Change

How might TRA, TAM, and similar models guide efforts to promote change in educational practice? Regardless of specific situational adaptations, these reasoned action models remind us that both acceptance and resistance are grounded in "reasonings," and change in behavior must be associated somehow with these underlying reasonings. A model that adequately represents the relationship between the decision to use technology and the underlying attitudinal and normative components can help us to target beliefs and perceptions that make a difference to what faculty actually do. In this section, we consider two pervasive faculty development strategies, using TRA to illuminate the process by which these strategies might affect behavior, and then use the model to generate new strategies that are not so obvious.

Incentives

One common strategy for encouraging the use of technology is to provide direct incentives for doing so. During summer 1998, the Faculty Development Partnership offered the incentive of a loaded laptop computer to recruit faculty members teaching General Education courses into one-week workshops on new technology and new teaching strategies (http://www.fcii/arizona.edu/gened). These workshops have been wildly successful, drawing many more recruits than can be served and generating rave reviews from faculty (e.g., http://www.fcii.arizona.edu/gened/may_18_participant_comments.htm). Yet the incentive offered is very modest relative to the time commitment required of the faculty members. We should not suppose that incentives work only through direct change in beliefs about outcomes of behavior (that is, by linking the acquisition of some good, like a laptop computer, to the performance of a behavior).

Incentives have complex functions. Besides their potential to directly affect beliefs about the outcomes of behavior, they may also indirectly affect other beliefs by providing direct experiential evidence on issues such as the difficulty of using technology and the impact of technology use on workload. However, incentives serve a more important and often overlooked function in educational institutions: They provide information on what it is the institution and its leaders value. Very small incentives often draw faculty effort out of all proportion to their practical value, in part because these incentives are frequently the only clear clues faculty have for figuring out the institution's current priorities. For this reason, over the past two years our Faculty Development Partnership has

been very explicit in linking any incentive offered to a statement of institutional objectives. The laptop program has been explicitly represented as a form of administrative support for General Education faculty, and our yearly internal grants program has for each of the past two years issued Calls for Proposals that incorporate a specific support agenda (such as building infrastructure for distributed learning—see the current CFP at http://www.facpartner.arizona.edu).

Training

A straightforward implication of TAM is that acceptance of technology can be increased by attacking the ease of use. One obvious way to do that is through training, and this has been a mainstay of Faculty Development at Arizona through both the volunteer phase (in which training was organized and offered by the Faculty Development Team in symposia, showcases, and other special events) and the Partnership phase (through which training has been offered mainly as workshops and individual consultation by the Library and the Faculty Center for Instructional Innovation).

Again, however, the relationship between strategy and behavior is complex. Training does often succeed in persuading people of the benefits of new technology, and it also often succeeds in overcoming beliefs about the difficulty of using new technology. As with incentives, however, training also provides normative information as a side benefit. Participants in the laptop program appreciated being introduced to new possibilities and helped with new skills, but they expressed real surprise at the value of interaction with their own peers. Comments by workshop participants are open on the web (http://www.fcii.arizona.edu/gened); a few of the norm-related comments are shown below:

1) I wish this opportunity could be available to all faculty members. The increased sense of community I feel and commitment to our common mission of teaching is amazing.
2) Having the opportunity to work closely with other faculty members from across campus has greatly increased my understanding of how, we as individual instructors, can collectively impact the education of our undergraduate students. As we shared our lessons and talked about writing in each of our courses, the big picture came together for me.
3) Apart from increasing my awareness of the new instructional possibilities technology opens up, the sense of community engendered among the participants was revelatory. The commitment to teaching on this campus is far greater than I and I gather others in the group had suspected.

Neither incentives nor training are designed specifically to take advantage of normative influence. On the contrary, incentives are usually conceptualized as a way to make the outcomes of the behavior more rewarding (leading to a more positive calculation of the behavior's consequences), and training is usually conceptualized as a way to overcome resistance associated with perceived difficulty, i.e., incidental lessons are associated with the information participants get about how the institution or the expert community values behavior. This suggests some less obvious avenues for promoting adoption of technology in education, relaying directly on well-understood structures for peer review.

Activity Reporting

In TRA, the powerful influence of what is recognized among children as "peer pressure" is modeled more generally as the subjective norm component. We believe that faculty are much more sensitive to normative influences than is suggested by the TAM, that strategies commonly understood as operating through the attitudinal component are effective partly because of incidental normative information, and that sensitivity to normative influence can be used to develop additional change strategies within educational organizations. Specifically, creation of structures that require or seem to require that faculty pay attention to their own use or non-use of technology establishes technology use as important to the expert community and as subject to normative evaluation.

Arizona has recently undergone comprehensive revision of its Tenure and Promotion guidelines. Use of technology is not explicitly linked to positive or negative decisions. However, the newly adopted reporting formats include sections for reporting of technology use and other forms of instructional innovation (http://w3.arizona.edu/~vprovacf/p&t/section6.html), and the simple occurrence of a reporting opportunity of this kind makes technology use a matter of normative influence. Not only does the reporting formation represent technology use as important to the faculty role, but also, the content reported by any faculty member becomes important normative information for any colleagues who review the dossier. Many faculty interpret the inclusion of

a reporting category of technology as a sign of institutional approval of technology use. TRA and its theoretical spin-offs suggest that one powerful form of support for change is creation of stronger normative beliefs—exploitation of peer pressure. Even without linking of the activity to outcomes, faculty who believe that their peers will be impressed by reported activity are more likely to engage in that activity.

Conclusion

To ameliorate faculty use of technology, we need better representations of why some adopt technology and why some resist it. This is the purpose of such models as the Theory of Reasoned Action and the Technology Acceptance Model. Working from detailed pictures of the determinants of technology use, our attention is directed to factors that influence intentions and behavior. In particular, these models direct our attention to often overlooked normative influences that may have powerful persuasive effects within educational organizations.

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Restructuring At The Classroom Level: Effects With Technology

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Abstract: From interview data with 17 teachers who wrote competitive project grants we conducted a preliminary analysis. From this sample, we selected 4 teachers to study in depth using interviews and observations to analyze how teachers used technology projects to restructure schools at the classroom level. Themes that emerged in all of the interviews included how curriculum, pedagogy, student learning and assessment changed in the restructured environment and challenges teachers faced with technology infusion.

1. Introduction

TIPS (Technologies in Pedagogical Strategies) is a collaborative partnership among the College of Education and Graduate Studies at the University of Wisconsin-River Falls; the Hudson, River Falls, and Prescott School Districts; St. Bridget Elementary School; and their respective communities. The funding for this project comes from the Wisconsin Department of Public Instruction Goals 2000 funds, University of Wisconsin-Extension, AT&T, and University of Wisconsin-System PK-16 Initiative. A key component of the partnership involves meaningful curricular integration of technology, so teachers and students may use this tool to foster higher-level thinking.

Our study focuses on one segment of the TIPS: teachers' curriculum integration projects. Last year, TIPS supported 35 teachers' individual or team projects to implement technology in their classrooms. Our goals in this research were to 1) document the kinds of technology being used to restructure schools at the classroom level; 2) identify some of the best practices and highlight specific projects that have been designed and implemented by teachers; 3) analyze the growth of respective teachers' experiences with technology integration and 4) identify challenges teachers face when infusing technology. A team of two faculty and four graduate students in the Teacher Education Department at the University of Wisconsin-River Falls reviewed 17 competitive project grants from 35 teachers and selected four projects for in-depth study and analysis.

2. Background

In the first year, twenty-three PK-20 faculty participants met on a monthly basis for specific instruction in using technology. During year two, thirty-six PK-20 faculty participated and a technology consultant worked in the schools with teams of participants and monitored individual teachers. For year three, sixteen PK-12 teachers, working with 18 university interns, provided technology mentoring and training to colleagues in their respective buildings in two school districts. During that year, the project supported 35 teachers' projects to implement technology in their classrooms, and interview and observational data from those teachers' projects form the basis of the research on which our proposal is based. Most recently, during the fourth year, 27 teachers and 27 interns in three school districts and a private school assisted others with the instructional integration of technology and supported 50 projects from over 100 teachers. Many states are providing grants to teachers to encourage technology integration. This research may provide some insight as to how teachers are changing teaching practices by introducing technology, and the effects of this pedagogical change on the learning outcomes of students in these teachers' classrooms.

2.1 How Technology is Being Used in Classrooms

Technology is infused in different ways at different degrees and styles across various content areas and grade levels. Schools have differing internal structures that support this endeavor, and each teacher is confronted with differing challenges. The future of technology in the classroom will depend on continued research and efficient support systems for teachers who are exploring new ways of teaching and of promoting learning. This research attempts to enhance our understanding of this complex process.

Our description of the projects will be summarized in accordance with four categories by which technology is used in the classroom: Instructional software, Instructional support tools/hardware, Telecommunicating/telecomputing/networking, and Multimedia [Forcier, 1996; Jonassen, 1996; Means, 1994; Newby, Stepich, Lehman and Russell, 1996; Roblyer, Edwards and Havriluk, 1997].

2.1.1 Instructional Software

This involves word processing; spreadsheets; simulations; tutorials; drill & practice; desktop publishing; CAD; problem solving games; test generator; instructional games; photo editing; Hyper Studio; and C-maps. Another category of instructional software is used to aid teachers in maintaining records of students' grades and other work. First grade students learn to use Hyper Studio software to construct an electronic portfolio. These portfolios are continued in subsequent grades so that students, teachers and parents have a multimedia record of the elementary education of individual students (see 3.1 Hyper Studio Electronic Portfolio Project). A new zip disk and an existing Alpha Smarts Program allow teachers and 2nd grade students to tackle large writing projects. An interactive laser disc simulation program is used in a middle school science class to promote math and problem solving skills as students figure out what caused an accident and other real life problems.

2.1.2 Instructional Support Tools/ Hardware

This refers to the physical or technological inventory contained in the learning environment. Examples include at the base level: computers; monitors; scanners; CD-ROM's; printers; LCD's; RGB-TV converters; audio speakers; modems; overhead projectors; closed circuit televisions; and calculators. At a more specialized level examples would include: CBL's, GPS's; digital cameras; digital video cameras; and zip drives. A high school calculus teacher has students using Global Positioning Satellite(GPS) Instrumentation to survey a practice field and snow fence. Students use the GPS, a traditional transit, and calculus applications to measure angles and curves and to plot coordinates of latitude and longitude. A high school biology teacher incorporates Calculator Based Laboratories (CBL) to examine how various pH levels affect reactions, to test the effectiveness of different strains of yeast, and to study the effects of various levels of exercise on heart rates.

2.1.3 Telecommunicating/Telecomputing/ Networking

This category comprises software and hardware which facilitates communication via technology utilizing e-mail; bulletin board systems; Internet; teleconferencing and video teleconferencing. These foster the linking of diverse databases, information sources, geographic areas and populations. Second graders are involved with an on-line project called "Journey North" where they track the growth of tulips with other students around the country. A middle school teacher relies on a subscription to the education web site which includes an author chat line to motivate her middle school English students. A 5th grade teacher assigns a famous woman to each of her students. The students use the Internet, Grollier's CD-ROM Encyclopedia, and the school library to do research on their assigned woman. The students fill out forms asking for specific information and present their findings to the class as a poster presentation. A 5th grade teacher has her students use the Internet to research the Civil War and specific topics of interest. Students create projects to show what they had learned, and they present them during an activity day where there is a re-enactment of a Civil War campsite among other activities. A middle school teacher uses e-mail and digital cameras for a project in his science class. The students pick out a variable (i.e. weather, height, etc.) and take a digital picture of the change from month to month. The students send their pictures to key-pals in a neighboring school. The teacher also has the students take a GPS home and send their key-pals the latitude and longitude of their family's homes. A social studies teacher's students select a WWII event; access primary documents such as diaries, newspaper articles, or photographs from the Internet and communicate their projects via participation in a teleconference (see 3.3 WWII Internet Project). A high school English teacher challenges her students to become critically aware of Internet sources. She teaches her students specific skills in examining electronic resources and encourages students to incorporate these and other resources into encompassing projects or term papers in the English classroom. (see 3.4 Evaluating Information Technology Project)

2.1.4 Multimedia

Multimedia is a computer system product that involves the integration of more than one medium into a form of communication by incorporating text, sound, pictures/graphics, and/or video. Digital cameras are used to record classroom activities, and later the information is inserted into Power Point for presentation to parents or other students, submitted to school newsletters or local newspapers, converted to VHS format for "video yearbooks," incorporated into individual classroom projects, or e-mailed to students at other schools. Electronic portfolios, which include representative samples of students' work across the content areas, are shown to the class through a Power Point presentation and later are taken home in VHS format. CBLs, which are connected to graphing calculators, allow students to collect data that is later presented to the class on an overhead projector; students discover information on their own while manipulating numbers on the calculators. A high school biology teacher has her students study organisms indigenous to the Kinnickinnic River basin. The students use digital cameras to make a field guide of the local flora. Through research on the Internet and library resources the students compile a final project on their organisms that are presented in a Power Point format (see 3.2 Kinnickinnic River Biology Project). Video cameras and advanced editing equipment allow students in a high school journalism class to make commercials and create newscasts of extracurricular and classroom activities for the school's broadcast.

3. In-depth Study of Four Projects

Follow-up focused interviews were conducted regarding the projects of one elementary and three secondary teachers (science, social studies and English). After presenting descriptions of each project, we summarize interview information about the changes teachers experienced in curriculum, pedagogy, student learning and assessment, as well as the challenges they faced integrating technology use in the classroom.

3.1 Hyper Studio Electronic Portfolio Project

The elementary teacher is a 1st grade teacher who is engaged in an ongoing five phase electronic portfolio project that is in its first phase. The goals of the project are threefold: 1) to help students become comfortable with computers and technology, 2) to provide students with a technology based project, and 3) to have students create an electronic portfolio that records their academic and extra-curricular achievements throughout their elementary school experience. The students are instructed in the rudiments of Hyper Studio software. The teacher used laminated cards in class to teach the children examples of Hyper Studio screens, keyboard functions and how to use a mouse. Students then worked in pairs to practice the Hyper Studio functions on the computer. After students learned to use the software, they worked independently on their computers to design their electronic portfolio. Students selected items from their hard-copy portfolio as well as current work samples to incorporate into their electronic portfolio. Students designed their electronic portfolio from start to finish.

3.2 Kinnickinnic River Biology Project

With the introduction of block scheduling, the science teacher wrote and implemented a new curriculum for a biology class that involved the Kinnickinnic River which is indigenous to the town of River Falls. The course was designed to allow students to research a macro and microorganism individually on the Internet as well as work collaboratively with other students in the class. Students were encouraged to tie in all the factors related to the ecosystem through food webs and by studying the ecosystem roles and plant life and insect life of the river. Components of this project included: poster presentations; sampling and identifying the actual macro invertebrates of the Kinni River basin; use of the CBL (Calculator Based Laboratories) such as testing the pH, oxygen content and temperature of the river to make conclusions on water quality; designing a food web; capturing images of the flora using a digital camera; and creating a Power Point presentation.

3.3 World War II Internet Project

Using an already existing course called World War II, the social studies teacher infused a technology based project with the goal of sharpening students' intellectual ability. Students were to choose a World War II topic and research it by accessing diaries, photographs, and documents off the Internet and participated in teleconferences. Eventually students were required to also relate Internet resources to print materials, articles, and books about the same event and make comparisons. One goal was that students would be able to critically analyze resources from the Internet. The second goal was for students to use a variety of methods of technology for the final project such as a scanner, quick camera, and camcorder to name a few. The end product differed from student to student ranging from a newspaper, teleconferencing, Power Point presentation and research paper.

3.4 Evaluating Information Technology Project

The English teacher infused technology into the classroom through a project that challenged students to assess and evaluate information technology. The unit required students to pick resources for a specific research topic and then decide if the resources were reliable, valid and appropriate. Topics ranged from Social Security to "beat" poetry of the 1950's and 1960's. Students were instructed to collect sources (text, electronic and human), list the strengths and weaknesses of the sources, rank the sources including a written explanation for the ranking, and develop a criteria the student deemed necessary for determining the appropriateness of sources. The students composed a "Works Cited" page and performed a concluding presentation to the class.

4. Findings

4.1 Curriculum

All four teachers commented that the technology projects required them to rethink what they teach in general while providing them an opportunity to think about what material to include in the curriculum more

specifically. Three important points brought up by three of the teachers included: 1) depth versus breadth, 2) factual content versus process, and 3) change in focus.

Regarding depth versus breadth, the social studies teacher stated that teachers may eventually move away from covering every single part of the curriculum to provide the "big picture" but rather turn to a project based pedagogy in which the project ends up dictating the content of the course. He said, "We let the big picture go and we concentrate on learning the smaller part of the picture well and not worry about covering all of the content."

For factual content versus process, the English teacher stated that in order to incorporate new tools (technology), some instructional time was used to address technology techniques and issues. Therefore, rather than focusing on the English content curriculum, she said she focused more on how students are processing the information.

Similarly, change in focus deals with the idea that teachers are starting to focus on skills they want students to develop in order to become independent learners who can access information on their own instead of focusing only on "what" we want to teach them.

The elementary teacher stated that curriculum and content were not significantly altered. However, she has been using hard-copy portfolios and students are already learning computer skills in their regular computer lab time. She said that this project was a very convenient way to combine those two preexisting activities.

4.2 Pedagogy

All four teachers stated that they have adopted a constructivist style of teaching that is student-centered and project based. They went on to say that they were able to address the variety of learners better in this setting, have moved away from a "teacher knows it all" model and have become much more reflective about their teaching style. The science teacher said,"... you really have to have quality projects planned out there (Kinni River) and they need to be projects that engage the students right away and require them to gather meaningful data, whatever that might be." She went on to state that without her involvement in the Kinni project she would not be questioning herself and her educational philosophy as critically. She said she is constantly trying to refine and develop her pedagogy. The English teacher said that this experience has forced her to rely more heavily on her students who are experts, and therefore she designs units that are more relevant to individual student ability and interest.

4.3 Student Learning

Consistent with the philosophy of a student-centered pedagogy, teachers said that students were taking more responsibility for their own learning, though at times students expressed frustration over the increase in responsibility. Students also developed analytical skills that required them to evaluate material obtained from the Internet for reliability and validity which was often assumed to be present for print material. Students were more focused on the process of learning rather than the end result, though most students were excited and felt very proud of their end products. The teachers stated that the students expressed that it was challenging to adjust to a new way of learning. Student motivation seemed be more intrinsic and student learning generally more positive.

The elementary teacher stated that several of her students who are not academically strong experienced many opportunities for success while engaged in the Hyper Studio electronic portfolio. The following are two examples from the elementary classroom. "One of my poorest readers read her story. She practiced forever and it's wonderful. I laugh every time I hear it." "He couldn't find much academically he wanted to put in but he played the guitar...into his portfolio...this success encouraged him to find other examples of his work which were academic in nature."

4.4 Assessment

The three secondary teachers said that the general structure of how they assess their students' learning did not change but modifications were made based on the nature of the task. For example, the social studies teacher stated that traditional quizzes, discussions, essays and oral presentations were used in general and performance tests were used for teleconferencing or Power Point presentations. Even in the case of performance assessment, he said"...you look at their regular research in the library of print media

and articles and you look at what they got off the Internet and assess their project, choices and their questions about the assignment." However, as the project evolved the idea of assessing higher order thinking became the central focus of the assessment.

The science teacher said she also used fairly typical written tests throughout the term. She administered weekly vocabulary quizzes that dealt with scientific terms and terminology, compilation of daily or regular data sheets twice a week, other daily assignments, projects and labs. She went on to say, that in an applied class like hers, projects like constructing the food web become good assessments of student learning. In order for the students to construct the web properly, students have to master certain concepts about flow of energy in the ecosystem and understand the definitions of the different ecosystem roles. She went on to say more student exchange occurred during this project than during other projects which she thought represented learning and higher order thinking amongst students.

The English teacher also stated that this project did not change her views about assessment in general. However, she felt that her views on assessment have changed gradually over the 24 years as she moved away from using tests to focusing on students' ability to demonstrate expertise.

The elementary teacher said that she did not think this project changed how she thought about assessment. She said at this level and with this type of assessment, watching them do their work through observations and looking for a successful portfolio was her main concern. She also noted that the students who had been academically challenged were producing more and providing better products at times. She did not provide an explanation for the cause of this observation at the time.

4.5 Challenges

There were general challenges and specific challenges related to infusing technology. Some of the general challenges included: making sure everybody stayed busy, not knowing if students were on task, decreasing the human contact with students, struggling with technology that did not cooperate, spending time teaching technology rather than using it for content instruction, overcoming one's own fear and resistance about using technology, and not establishing objective and controlled ways to assess your own practice.

Specifically, the elementary teacher saw the continuation of student portfolios throughout the subsequent grades as a challenge. One of the significant challenges she saw was how other teachers will become a part of this continuation especially if they lack computer skills. The science teacher noted that complex projects, increased student autonomy and variability of tasks which produced a challenge for objective and efficient methods of grading. The social studies teacher said that one of the main concerns he had was students' lack of necessary background knowledge needed to engage in higher-order thinking, which he envisioned would be the result of this project.

5. Conclusion

The projects implemented by the four teachers have been an avenue by which they were challenged to rethink "what" they teach and "how" they teach. Technology alone can not explain, nor can it become the sole answer for our exploration about changes in curriculum and pedagogy at this present time. Naturally, when a new idea, method or way of doing things is introduced, the tendency is to become more aware of how one does things. Whether novelty of a new method of teaching has caused the changes we observed or technology itself has been the primary cause warrants additional study for us to draw further conclusions. However, teachers' thinking about what they teach and how they teach have been positive outcomes related to these projects nonetheless.

Teachers have moved to a student-centered pedagogy allowing for more ownership and responsibility of student learning. There is still much to learn about how technology infusion changes our way of thinking about assessment and our assessment practices. Despite the many challenges these teachers faced, their innovative ideas and pioneering spirits have encouraged us to explore how classrooms can be restructured through the use of technology.

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TELECOMMUNICATIONS – GRADUATE, IN-SERVICE & FACULTY USE

Integrating Computer-Mediated Communication in the K-12 Curriculum

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This paper is the result of a group article done in a graduate instructional technology class. The authors all teach in the K-12 setting and drew upon Internet sources, as well as personal experiences, with keypals, electronic mentoring, tele-field trips, and online collaborative projects. Definitions, benefits, possible problems and tips are given for each of the areas.

As we move into the 21st century, technology has grown in schools so much that it is now a vital part of our children's education. In fact technology is just as important to our students and teachers as any other discipline. The challenge for many teachers at all grade levels is how to keep up with the fast growing pace of new and expanding technology while maintaining a learning environment for the students. Integrating technology into the everyday curricula is the most productive way for teachers to expand the learning levels of the students. One such way to allow integration in the classrooms is through the Internet. There are many ways to involve students with the Internet. This paper will discuss the following four ways to integrate computer-mediated communication into the K-12 classroom: keypals, electronic mentoring, tele-field trips, and online collaborative projects.

KEYPALS

Many of the uses of technology resemble the ways that teachers did things in the more traditional. One of the first ways in which people used telecommuting in their classrooms was to write letters to other students over the internet much the same way that they wrote to pen pals and sent the letters through the mail. Keypals allows individuals to "talk" electronically to other individuals, or individuals to talk to groups or groups to talk to other groups. It is still one of the most popular types of electronic telecommuting activities.

Since "keypals" require access to the Internet for individual students most teachers use one email address to facilitate this activity. LISTSERVs , newsgroups or Internet –connected bulletin boards can also be used as the common contact for exchanges. Keypals can be a very rewarding activity for many students. They are often stimulated educationally through these exchanges with other students. Another benefit can be the exchange of ideas with people their own age but from a different culture. Some examples of keypals may include a call for letters to exchange information from different towns in the USA.

One of the main problems with keypals is the management of this activity. Since each student needs to use an email address and be on the Internet, many teachers may not have time to devote to this type of activity. An easier activity to manage for the classroom teacher may be a group to group exchange also called global classrooms. In the global classroom activity, two or more classrooms located anywhere in the world may exchange information or ideas on any subject that is of interest to them. Group to group exchanges often

address current issues and problems that are more open ended so that students can express their own ideas on the issue. One example of a group to group exchange is asking high school students around the globe in commemoration of Earth Day to respond to Robert Frost's and Maya Angelou's poems read during Bill Clinton's 1992 Inaugural Day ceremony. As teachers collect the responses they can use them in their classroom discussion. Also many teachers feel that if they facilitate young people coming together from different, often distant places, to share ideas on the world's problems, real solutions may be implemented as these students grow into adulthood.

One specific population that is positively affected by the use of keypals is the rural districts that criss-cross this country. Students living in rural areas of our country are often isolated from other populations in America and the world. They rely on electronic communication to expand their perspective on current issues and educational ideas. They may be influenced to expand their horizons when considering career choices. Many rural school districts have to make tough decisions regarding the issue of scarce resources to fund Internet access for their students, but most rural districts have been pleased with the results of such investments. School administrator Bruce O. Baker (Baker & Hall 1994) has stated that using the Internet to connect students in his district and others can help overcome the disadvantages of geographic isolation. The problem of funding as the technology changes is an issue for not only rural districts but also all schools districts in our country.

ELECTRONIC MENTORING

The concept of the mentor has a long past, ranging from that of a trusted guide to the modern meaning of mentor (Roche 1979). Mentoring has been used to help individuals develop psychologically, occupationally, and cognitively. Educators have found that pairing students interested in a particular topic with educators who have expertise in that topic is an effective learning relationship. Widely known as instructional mentoring, students can gain specific knowledge from experts in a field when they have exhausted traditional resources for information (e.g., the teacher, encyclopedia). In addition, an instructional mentor can personalize the information for the student, often making the content more meaningful. With the invention of electronic communication, the definition of mentor has been broadened to include experts who know the student through electronic means alone (email or the WWW). Teachers are matching their students with online instructional mentors to give their students an additional resource when studying a specific topic in the curriculum.

Many universities around the United States have programs that teachers and students can join to become connected with subject experts from all around the globe. For example, The Electronic Emissary Project (Harris 1994), based at the University of Texas at Austin, is a service that helps connect teachers and students to experts in different disciplines. The experts are found by posting announcements to selected Internet-wide LISTSERV groups. The experts post their areas of expertise that they would be willing to share with K-12 students to an interactively-accessible online database. The information that the prospective mentor enters is then searched by topic, by classroom teachers wanting to request "matches" for their students.

Many students from K-12 have used the Emissary to find experts to answer specific questions or just communicate with via electronic email. Second grade students in Reading, Massachusetts studying magnetism were connected with a physicist from Arizona State University. Fourth grade students in Fort Worth, Texas communicated with an astronomer and planetarium coordinator from Louisville, Kentucky about specific questions they had about the solar system. Ninth grade students in Hart, Texas communicated with an engineering professor from Boston University about waves and wave phenomena. Twelfth grade students in Atherton, California communicated with a computer scientist about their individual projects in cosmology. Consequently students from all grades have benefited from electronic mentoring.

TELE-FIELD TRIPS

The ultimate objective of today's school is to provide students with a well-rounded education, and one of the ways many schools accomplish this ultimate goal is through field trips. Field trips provide students with the opportunity to communicate with the community. Many organizations such as NASA, Houston Lighting and Power, and other industries are happy to open their doors to teachers and students so that they

can explore what is going on. Although fieldtrips provide the best form of student to community communication, sometimes they are inconvenient, expensive and not feasible. Through sophisticated technology, all schools can have the opportunity to take fieldtrips.

Tele-field trips involve the sharing of information gathered by expert teams, teachers, or students with others all over the world via the Internet. For example, if class A goes to the local city zoo, they can post what they saw for class B that is in another part of the country where the closest zoo is five hundred miles away. Also, class B can email questions to class A about their fieldtrip to the zoo. Also, tele-field trips involve various experts such as explorers and scientists posting their many findings on the Internet for teachers and students to see.

A school district in Springfield, Illinois is heavily involved with tele-field trips projects such as a cow's eye dissection, a walk along the Nile, the Oregon trail, live from the stratosphere, Maya Quest, the Titanic, the journey North, adventure online, dinosaur dig, and much more (http://www.springfield.k12.il.us/resources/webprojs/fieldtrips.htm). Some of these tele-field trips consist of extended year curriculum, photos, movies clips, dialogue, etc.

Some of the above tele-field trips are sponsored by various expert teams; for example, The Adventure Online tele-field trips feature various expeditions such as running the Nile, global adventure, Arctic challenge, and project Central America. The running the Nile tele-field trip is sponsored by a team of kayakers, and the project Central America is sponsored by a team of mountain bikers. These individuals have diverse backgrounds ranging from educators to global adventure travelers.

There are many tele-field trip projects available at no cost, but some require a subscription fee or site license fee. These fees can range from about ninety-seven dollars per password or subscription and higher, and some sponsors offer a group discount for the purchase of several subscriptions or passwords (www.houston.isd.tenet.edu/techinst). So teachers who want to participate in tele-field trips have a wide range of options available.

ONLINE COLLABORATIVE PROJECTS

Online projects usually require collaborative work within a team and take the form of hypermedia. They have many benefits over traditional projects, including searching, handling of dynamic information and team working. Online projects provide students with equal opportunities to get to know what research is and how it is conducted. It is meaningful in terms of fostering students' scientific thinking and behavior. Since information is in abundance on the WWW, it is impossible for each student to exhaust all the links listed under a project. Teamwork is then a natural solution to the problem. Each student has a chance to play a role in order to get the job done. In addition, a lot more freedom doesn't guarantee learning. Students may learn to discern what kind of information suits their topic, and which one should take priority over others. Therefore, online projects cognitively facilitate collaborative and discovery learning.

To get started with collaborative projects there are some things that need to be kept in mind. Teachers should examine lesson plans and review the curriculum to identify activities that could be enhanced if re-engineered into an online collaborative project. It would be a good idea to visit several online collaborative project sites (examples are listed below) to see how others have organized their project. Also contacting the site webmaster (an e-mail address is usually listed on the site's home page) and asking questions about conducting online projects would be a valuable use of the teacher's scarce time. Once a project is decided upon the teacher should outline the specifics of the project, including information such as the name of the project (give it a "catchy" title), the curriculum objective it addresses, the grade level(s) that it is for, etc. Then the teacher can post a "Request for Participants" in several educational listservs and newsgroups. Once the participants are enlisted, the teacher is ready to begin.

Samples of Online Collaborative Projects:
Elementary (Grades K-5)

McGraw-Hill School Division (http://www.mmhschool.com/teach/teach1.html)

Each project is a directed exploration of a site on the World Wide Web and includes a comprehensive lesson plan and a printable blackline master. Project topics cover a variety of subject areas ranging from language arts to social studies to mathematics and natural science.

Monticello World Wide Web Lessons (http://www.monticello.org/Matters/people/plans.html)
Learn about Thomas Jefferson and his life at Monticello. This web site contains a lesson plan, an activity, and a teacher answer key.

Project ScienceSpace (http://www.virtual.gmu.edu/)
The purpose of this project is to explore the strengths and limits of virtual reality (sensory immersion, 3-D representation) as a medium for science education.

Global SchoolNet Foundation (http://www.gsn.org/project/index.html)
This site contains a variety of links to online projects.

NickNacks (http://www1.minn.net/~schubert/EdHelpers.html)
This site contains links to interactive projects.

The JASON Project (http://www.jasonproject.org/front.html)
The purpose of the JASON Foundation is to excite and engage students in science and technology, and to motivate and provide professional development for their teachers through the use of advanced interactive telecommunications.

Secondary (Grades 6 – 12)

Mars Academy (http://www.marsacademy.com/)
An educational collaborative project in which participants will design and simulate a manned mission to the Red Planet.

Encyclopedia of Women's History (http://www.teleport.com/~megaines/women.html)
Collectively provides a celebration of Women's History for students, as well as provides a starting point for further research.

European Schools Project (http://www.esp.educ.uva.nl/)
This project supports teachers and students in participating in the world of Internet-based Computer Mediated Communications and in using the Internet's Information Resources to improve learning and teaching. A project listing can be found at:
http://www.kc.kuleuven.ac.be/esp/prtitles.pht
Some examples of current online projects include Human Genetics, "Down the Drain" water consumption project, and "Me and Media".

The World Band Project (http://co-nect.bbn.com/WorldBand/Pages/WorldBand.html)
This project involves realizing musical activity electronically, both locally and over the Internet. Emphasizes learning to collaboratively create music with partners at other sites.

Global Schoolhouse (http://www.gsh/org/project/index.html)
This site contains a listing of secondary-level online collaborative projects, including Holocaust/Genocide Project, MathWorld Interactive, Global Cultural Shock, and "To Exam or Not To Exam".

Possible Problems of Online Collaborative Projects
Flexibility is one of the online projects' strengths; however, it may possibly lead to some difficulties due to inconsistency. Since those recommended links in a certain online project are prepared by other teachers, they may not suit your students' particular learning style or your intended instruction. If you just let your students go with that online project, inconsistency of format or content might occur. It is always a good idea to identify your teaching content before you start using any online project for your class. When necessary, select certain parts of an already existing project and add your own desired material.

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Teaching and Learning with the Internet: Issues for Training Special Education Teachers

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Abstract: This paper is a report on the findings of a study conducted on a graduate level course for teaching and learning with the Internet for high school teachers working with students having severe learning and emotional disabilities. Qualitative interview data was used to explore issues throughout the course as teachers used information in their classrooms. The results indicate that ongoing inservice education needs to be specific to identified classroom needs. Teachers integrating technology into the special education classroom face an extremely diverse student body. There should ongoing development for teachers as they work through teaching and learning with the Internet in their classrooms. Results also indicate that it is important to realize how special education teachers can use the tool in their classrooms, understand why they use the Internet, what it accomplishes for their own personal teaching and learning needs.

Introduction

Inservice staff development for technology has historically consisted of school district courses designed to instruct teachers on emerging issues for teaching and learning within the classroom. These courses are generally brief, short term, and range from one day to a series of three or four days across a semester (Claxton, 1996). Courses designed in such a way do not meet the recommendations made in the literature for continuous, ongoing inservice technology-based staff development training (U.S. Department of Education, 1997). Many of these courses do not deal effectively with the integration of new teaching ideas into the curriculum because of the quality and quantity of training necessary for teacher growth. Given recent innovations in technology and teacher practice, many inservice staff development efforts have not changed. As a result, the potential benefits for innovative teaching methodologies and tools, such as student directed learning and the Internet are not fully understood. Ongoing research is currently needed to identify the development role of the teacher in a high technical classroom and keep this role as clear as possible (Rogers & Mahler, 1992).

The role of the classroom special education teacher has changed due to a variety of forces that have been effecting the field of teaching. Laws in special education are requiring the consideration of assistive technology in the Individualized Education Plan (Behrmann, 1998). There is an increasing amount of money available for schools to purchase technology and the social context for 21st century schooling is quickly evolving. Also, there have been advances in our understanding of how people learn (Doyle, W., 1979). Additionally, standards have been developed by the federal government, state educational agencies, local school boards, and within national teaching organizations (International Society for Technology in Education - ISTE, Council for Exceptional Children - CEC) to encourage

effective technology practice. Access to the Internet has greatly increased and teachers are changing classroom curriculum to accommodate new information tools. All of these forces combined place the special education classroom teacher in an exciting yet difficult position. In order to facilitate the position of teachers, ongoing support and training is necessary.

The purpose of this study was to question the development of teacher attitudes and practices of the Internet through elements within a university course designed for technology integration. These questions are critical because of the increasing presence of the Internet in schools, but more specifically, because of the necessity to assess pedagogical beliefs and experiences with new forms of learning (Dede, 1998) while exploring the way learning environments are changing because of access to the Internet (U.S. Department of Education, 1995; Benton Foundation, 1997).

An inservice university training course developed for special educators learning to integrate the Internet into classroom instruction. The goal of this course was to expose teachers to emerging technologies and innovative forms of teaching as well as provide the teachers with the information, skills, and problem solving methods to critically think about the integration of technology into the special education curriculum. The broader scope of this study answered questions about issues for teaching and learning with the Internet for high school students with severe emotional and learning disabilities and the context of special schools and new technology tools. An additional question included in this study provides the specific focus of this paper:

> *How do high school teachers working with student having severe emotional and learning disabilities report using the Internet after participating in an inservice training course designed for technology integration?*

The Study

Data was collected from 5 course participants in course EDSE600 - Technology Integration in the Classroom during the 1997-98 school year. The course was contracted with the Training and Development school, a non-profit organization serving students with severe emotional and learning disabilities in a level 5 restricted facility. There were 24 teachers selected to participate in the course that were currently working within each of the four schools. Two of these teachers were male and three were female. All of these teachers were within their first two years of teaching within their school, although each had prior experiences working with students having severe emotional and learning disabilities. In addition, all of these teachers were working on ED/LD certification during this time period.

As part of a research study, data was collected from course participants to answer questions about the issues for teaching and learning with the Internet in their classrooms. Data was also collected to explore how school and student context influences special education teachers' use of new technology tools and to analyze how teachers integrate new knowledge of teaching innovations throughout a inservice training course. Data consisted of interviews, a teacher post-survey, electronic course discussions on Townhall (an electronic discussion group), individual teacher journals, and teacher lesson plans.

Administrator and teacher interviews were the primary mode of data collection for this research question. The teachers were selected mid-point in the semester and interviewed twice, once during and once after the course was completed. Two out of the available eight administrators were chosen for interviews based on time restraints and availability. Interview

data was explored using qualitative analysis methods (Miles & Huberman, 1986 & Maxwell, 1986). Emerging themes and ideas were used to justify research questions and to synthesize and report issues related to teaching and learning with the Internet in their schools/classrooms. A post-survey was used as one method to triangulate interview data and collect teacher reports on the last day of class.

Findings

The impact of an inservice training course for high school special education teacher of students with severe emotional disabilities is multidimensional. An analysis of the data reflected many issues teachers face for instructing these students and the potential uses and limitations of the Internet as a tool for teaching and learning. Teachers of students with disabilities have additional factors to consider when planning for the Internet. It is therefore important to know why and how teachers are using the Internet to facilitate the integration of the tool into the classroom. The dialogue between the instructor and teacher during this course was important for developing knowledge about what was working in the classroom as well as the content/skills teachers needed in the course to continue their development. A synopsis of teacher responses and an item from the post-survey are reported in the following sections.

Teachers Working with the Internet

Teachers responded differently to taking students into the computer lab. When the issues of risk and whether or not teachers thought there was risk involved in taking students to the computer lab, Teacher D was the only person who was too "nervous" to take them into the lab. Other teachers expressed various levels of frustration while working in the lab on the Internet. Some of the frustration had to do with the "amount of printing that students do" and the fact that they did not "know how to trouble shoot". Teacher A expressed that he did not have the time to plan for Internet activities and Teacher E stated that he liked using the computer lab, but that he could never go in there (the lab) without having a clear idea of what he was going to do. "Every time I have done that, it causes problems and everybody wants to print. I guess the reason why the Internet doesn't bother me because you really don't have to worry about student work getting erased. Something crashes or you log-on and it is busy and you can come back later and it is there".

Teacher B liked using the Internet because she could integrate it into her teaching style and how she thought students learned:

> Interviewer: *Have you made any conclusions about how kids learn differently in class?*
>
> Teacher B: *Actually, I think that the Internet helps them...because it provides that type of accomplishment in their own time and with their own abilities and their own pace. Either they discover the web-site themselves, or I introduce it to them as they go and what they need to do, at the rate that they can do it. You know, and even though the computers are all there together, it is not like you are sitting there and worrying that these kids are finished, because they go looking for something else.*

And if it takes them a few weeks to type up their report, other people are still doing web stuff and it is in their own time frame and it is less intimidating that way.

Teacher C was enthusiastic about her time in the computer lab and working with students on the Internet. This seemed based on how she thought students would engage in activities. It also reduced her individual stress because the use of the Internet was a motivator for students to complete assignments:

Teacher C: *For me it is easier when I know that I have the computer lab in my schedule in the afternoon. It is easier for me to plan for the computer, because I can see that the whole afternoon is going to be relaxed. So the kids usually behave. I understand that in regular schools that issue might not matter because they don't have the problems that I have working with these students. It is nice that they are motivated by the Internet, because in the morning I can say that if we don't finish what we have to do, we will not be able to go to the computer lab and they finish their classwork.*

However, Teacher C continued to be reluctant to allow students to have e-mail and to interact with other students on the Internet. She did believe that interacting with other students on the Internet would be a good form of learning, but she did not feel comfortable giving them the freedom to 'interact however they want":

Teacher C: *I'm still thinking I should give the kids a pen pal, but I haven't made a decision about that yet. (The students) would probably get excited about the idea...but I wouldn't try it and I am afraid it wouldn't work right. Even when they went into the translation site on the Internet, they get excited, but the first thing they start writing is all the bad words in English, and you cannot get them back on task.*

Teacher A specifically liked using the Internet because of the resources it provided him as he prepared for his classes:

Teacher A: *I didn't have a lot of resources as it was, so to have the Internet, where I was doing everything from current events to looking up experts. Instead of having to worry about getting the morning paper, all I have to do is get on the Internet and we go to the Washington Post. Or in the case of my health class, there is always something I can do with the information available on the net.*

Teacher D never took his classes into the computer lab to work with the Internet, but would send students to the librarian to look for materials. At one point, the only access within the school was the librarian's computer. After the school was "hooked-up", Teacher D continued to use the librarian as a resource for the Internet. He liked being able to send students to the librarian to work independently. When President Clinton went to Gambia, Teacher D thought that he could use the Internet with his students; however, he could not find the site that followed Clinton's travels. He became frustrated with searching the Internet and said, " I felt like I missed an opportunity and that really bothered me".

Teacher A, Teacher B, and Teacher E also express negative aspects of the Internet, especially the amount of time that it took to preview sites for students when planning specific

activities because he thought the Internet was so "wide open". They all felt the need to view materials before integrating the Internet into their daily activities:

> Teacher A: *I used (the Internet), I found it to be a great learning tool, but it's time-consuming from the standpoint of a teacher using it to checkout what's there. I've learned the hard way that you really have to preview the stuff to know where everything is.*

Why Teachers Use the Internet

Teachers responded to questions on a post-survey. One of the questions specifically addressed why teachers used the Internet. Their individual responses are reported in tallied format as "frequency of response", for a total of five teachers.

You use the Internet at school because you want:	1	2	3	4
to increase student motivation and participation in their own learning		1		4
to provide opportunities for students who do not have computers at home	1		3	1
to fulfill parents' and students' expectations	2	3		
to give students the skills they need in college	1		2	2
to prepare students for an increasingly technical society			2	3
to help students feel more a part of the global community		1	2	2
to keep up with new technologies yourself to gain access			2	3
to find out about new teaching practices			3	2
to overcome remoteness or geographic isolation in your school or community	2	1	1	1
to reduce your professional isolation through e-mail or collaboration with others	3		2	
to overcome a lack of specialized staff or limited program offerings at your school	1	1	2	1
to access resources or materials that are not available in textbooks or in the library			3	2
to support larger school change efforts by using the Internet as a catalyst for school change			3	2

Table 1: Teacher responses based on a Likert scale ranging from 1 - 4, where 1 = not a reason at all and 4 = very important reason.

Considerations for faculty working with Special Education Teachers

Teachers felt that their knowledge of teaching and having time to develop an inventory of lesson plans was important to their success in the classroom. There were several first year teaching issues related to 'time and priorities'. Teachers needed more time for developing lessons and adapting to a new teaching and learning environment. Apart from school context issues and personal teaching pressures, teachers needed extra time to implement a new "technology innovation". Teachers did not have lessons developed, so they were not integrating the Internet into existing instruction, they were developing new instruction that included Internet integration activities:

> Teacher A: *As a first-year teacher, and because this teaching situation is so overwhelming, I did spend a lot of time calling parents and asking teachers other questions...Since this is my first year of teaching, I don't have many of the resources that they do. There is this other teacher next to me who has worked in the field for a few years and uses the Internet. She has a wealth of projects that she has already done. I would have the same if I had remained in teaching. But I didn't so I have*

been trying to rely on the resources that I have. If I decide to stay here next year, I will spend some time over the summer trying to develop some plans... I think technology has a great ability to enhance teaching...and I think people will develop better ideas about teaching and learning over the next few years.

Since many of these teachers were working on their certification during this course, inservice efforts were necessary to help them meet certification requirements and develop the skills needed to work with technology. Teachers attempted to collaborate with each other but there was limited time during the school day. During class sessions, there was an opportunity for teachers to work collaboratively on academic projects. As a result, teachers shared information and had time to merge new ideas about the Internet within their daily classroom activities.

Conclusions

Ongoing support was necessary for these teachers as they attempted to work with the Internet during instructional activities. These teachers struggled with how to use the Internet with their students. During the span of the course, 4 teachers left the Training & Development schools. Out of the five participants in the study, only three returned for their second year of teaching. For these teachers, the majority of their knowledge about teaching and learning, technology were developed during this course and based on their prior experiences working with these students. In order to increase support for teachers working with these students, inservice education needs to provide teachers with the ideas, time, and support to enable integration of technology into the curriculum. Individuals creating and/or delivering such programs need to think about several things.

First, in order to deliver inservice training specific to the use of the Internet, it was necessary to realize how teachers were using the tool in their classrooms. Teachers expressed that they continue to use the Internet primarily as a search and retrieval tool, however, the methods they used to structure their classrooms and deliver these lessons became more student oriented and directed. Although students were not interacting on the Internet in communication forums, teachers used the information on the Internet to adapt content to individual reading levels and personal capabilities. Teachers expressed difficulty working with the identified texts for their curriculum. Teachers needed to consistently explore new forms of content to deliver to the students. Teachers need to be aware of the literacy opportunities on the web for students with disabilities. Teachers of students with disabilities need to consider how technology can be integrated into their curriculum.

Secondly, it is important to understand why teachers want to use the Internet in their classroom and what it accomplishes for their own personal teaching and learning needs. Teachers felt that working with students on the computers and with the Internet was applicable to student learning, allowed students to work for longer periods of time, increased individualization. Using the Internet both reduced stress and increased stress depending on how familiar teachers were with the computer. Teachers ultimately responded on many different levels in response to using the computer lab and the Internet. Some teachers responded that they liked using the computer lab, worked with their students on a daily basis, but felt uncomfortable with their technology skills. Teachers liked using the Internet because students were often "better behaved". However, when there was a crisis involving technical difficulty, students did not have the patience to wait and give teachers a chance to resolve the

issue. Other teachers seemed to be less concerned with knowing where to go and how to trouble shoot. Still others were too concerned about having technical difficulties and therefore did not make use of the lab. They also used the Internet for accommodating their students, working with real-life materials, and being less teacher-directed while working with the computer. Students seems to respond to teaching and learning more directly in the computer lab and it seemed to take some stress off of the teachers. However, it added additional stress to some teachers because they felt it "took more time" to develop lessons, or made them nervous because they had difficulty controlling "where students were going".

Third, ongoing development for teachers working with students having severe emotional and learning disabilities is important because they may not have the fundamentals provided in methods courses at the preservice education level. A portion major portion of learning happens after they have received a teaching assignment. As a result, one-shot methods for instructional development, especially with technology, may not have lasting influences on classroom instruction.

This course ran over a period of eight months. At the end of the eighth month, there were teachers who still did not know how to complete basic computer functions and were not integrating the Internet into their instruction. In some cases, it wasn't until after the course was over and the last round of interviews were completed, that two of the research study participants started to use the Internet (during the extended school year session). The teacher burnout rate in these programs can be high. Training and "retaining" these teachers can be difficult. It is important to realize how teachers were using the tool in their classrooms, understand why teachers use the Internet in their classroom, what it accomplishes for their own personal teaching and learning needs, and how it "fits" with prior knowledge. Inservice courses that do not meet their specific needs may not influence classroom instruction. Knowing how special education teachers are using the Internet in their instruction, why they are using it, and the open discourse necessary to work with these teachers in the classroom is extremely important.

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Conducting an Interactive Workshop Over the WWW

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Abstract: An inservice workshop was conducted over the WWW to evaluate several interactive components designed for the course. The workshop evaluated a web-based threaded discussion application, e-mail, shared workspaces, and an on-line participant contribution page for resources. Despite a wide range of participant computer experience, the teachers rated the on-line web course very highly. Participants evaluated the interactive web components of the workshop very high and e-mail less useful even though they were more familiar with e-mail at the beginning of the course. With the availability of web teaching software packages increasing, further study and evaluation of the effectiveness of teaching with the interactive features on the Web should be conducted.

Introduction

Many people exploring the effectiveness of delivering instruction over the Web. This delivery format is evolving and providing fertile ground for experimentation and evaluation. Numerous software packages that allow instructors to create a web course and teach it electronically are appearing on university campuses nationwide. Incentives for creating web-based courses are being offered to faculty willing to experiment with this form of instructional delivery. The web teaching software packages are including more and more interactive features to design instructional experiences and activities for students. Features such as interactive testing and feedback, video conferencing, chat rooms, threaded discussion boards, shared work spaces and e-mail are all being used as instructional strategies in these on-line courses.

This paper describes a workshop for inservice teachers. The workshop was conducted over the Web during the summer of 1998 and the resulting evaluation of that workshop. The workshop course design attempted to incorporate interactive components of web instruction rather than passive, text and graphic only materials. Evaluation of the quality and usefulness of information or experiences provided through these interactive web features should be conducted to determine the most appropriate use in web-based instruction. As the number of web-based courses increases, more information about effective design and best practices in this new instructional field should be collected.

Course Design

This workshop was advertised throughout a midwest state to recruit K-12 teachers as participants. This state contributes to the support of a K-12 Internet access system which has enabled K-12 teachers across the state to participate in workshops of this nature. The course materials and field study were funded by a grant, therefore, the only expense to participants was the optional graduate tuition. Thirteen K-12 teachers from both urban and rural school districts in the state enrolled, participated, and completed the workshop.

The three-week long workshop was designed to incorporate both web-based and face-to-face modes of instruction. Concern over the completion rate of many other web-based prompted the combination of modes of instruction. Participants met face-to-face for an orientation and training day. During this day, the participants were introduced to the course web site, and a sample teaching lesson from

the course was modeled for the participants. The teachers were allowed to practice navigating the web site and received help with such items as telnet to access their school e-mail accounts from remote locations. The participants returned home to work on the course for the next two weeks. The workshop concluded with three-day field study trip and two days in the computer lab to develop a web-based K-12 classroom lesson that the teachers completed by the end of the workshop.

Two textbooks, an interactive CD-ROM program, and the web site were used to deliver the content information for the workshop. The web site included lesson pages that used a variety of formats to deliver the information. The interactive features included a web threaded-discussion forum, e-mail, and interactive pages with shared work areas and information contributions posted by participants for the group. There were nine content lessons on the Web during the workshop. Two or three content lessons were made available every four days during the workshop. The content lessons required the participants to use the web site, the texts and CD-ROM materials, as well as other web resources that were posted on the resources page. Participants, during the course, posted web resources they had discovered to share with the group. E-mail messages to the entire group provided announcements regarding the progress on the availability of the content lesson links.

The threaded discussion application allowed the participants to respond to questions over the content lessons and to questions posted by other participants. The web resource contribution page and the shared workspace page were dynamic web pages that were supported by a FileMaker Pro database running in the background. These pages allowed the participants to enter information and post it or save it to make further changes as they worked. The shared work spaces allowed the students to log in and view the work others had done, add, delete or edit the work, and then upon designating it completed, post it to the page for display. All facets of the workshop were evaluated with special attention focusing on the on-line portion of the workshop.

Findings

Participants viewed all of the workshop components positively. The web-based instruction was consistently rated highly as well. A preliminary survey of the participants revealed that only one third had any prior experience with distance learning, correspondence, or on-line course work. Participants were most comfortable with e-mail and half of the participants reported only an average confidence level with a web browser or a threaded discussion application. In the final evaluation, a five point Likert scale was used with five being high. The participants rated the web features of the workshop at 4.75 for both quality and usefulness in the workshop. The on-line content lessons were rated 4.42 for quality and 4.25 for usefulness. Finally, the threaded discussion application was rated 4.42 for informative, 4.6 for usefulness, and 4.6 for ease of use.

The final evaluation also asked participants to identify the average amount of time spent on-line for the course. All of the participants reported different amounts of time spent on-line with no pattern. The participants were also surveyed as to the frequency of use for the on-line portion of the workshop. Eleven of the thirteen participants reported using the on-line features everyday or every two days during the on-line segment of the workshop. And even though participants reported being most comfortable with e-mail prior to the start of the workshop, only five reported a high frequency of use for e-mail during the course. All participants said they would recommend this web-based workshop to other teachers.

Conclusions

This workshop format of combining the orientation day, field study trip, and the web-based instruction worked very well for the K-12 teachers who participated. All of the teachers completed the workshop even though only half registered for graduate credit. The participants reported a positive experience in the web-based workshop and most reported increasing their computer skills as well as increasing their content knowledge as a result of participating. The high ratings by the participants were somewhat surprising as there were some computer glitches experienced by the participants. The participants thought technical support would have been helpful, but realized the distance between their physical locations made it impossible to provide that type of support. The participants also noted the flexibility of asynchronous scheduling made possible by the web format was very helpful to them. The

variety in the answers about the average length of sessions spent on-line would support the fact that the participants all worked in a variety of personal schedules during the course. Combining both face-to-face sessions and web sessions in this workshop was successful.

In light of the fact that the course was advertised statewide and all expenses were paid, the small number of participants that actually enrolled might raise some questions about the teacher's interest in using the Internet for instructional delivery or in distance learning courses. More information would need to be collected before it could be determined what role computer literacy and skills of the K-12 teachers at the current time would play in determining enrollments for web-based courses. The teachers found the web-based components of the course to be very user friendly and used them in place of e-mail although they were more familiar with the e-mail applications at the beginning of the workshop.

The workshop provided an opportunity to use interactive web pages for instruction. During the course of the workshop, it became evident that other interactive designs would be useful as instructional strategies over the Web. Some of the interactive strategies to be incorporated into the workshop for the next time it is taught include:

1. Small group e-mail discussions, which result in a consensus reply to the discussion forum.
2. Use of the shared work areas for teachers to develop group responses to issues or debates.
3. On-line web directed instruction using two browser windows to direct instruction and keep the learners "on task."
4. On-line office hours by the instructor, who would be available for e-mail, chat or phone conversations.
5. Participants (individually, with a partner, or in a small group) could create their own web page illustrating their perspectives and post it for discussion and response by the group.
6. Participants submit a web page with a series of links and images to verify or illustrate their responses to information or issues.
7. Participants can use on-line tools to generate maps, diagrams or graphs as responses to discussions or issues and post those for other participants and the instructor to review.

These additional design features would keep participants actively involved in the course during the time they are working from home. They will also be included with the hope of developing a network or community among the participants so they will get to know one another better and rely on each other for ideas and content help after the course has ended.

For Further Study

The World Wide Web has great potential for interactive communication and eliminating distance issues that might have previously prohibited people from participating in classes and workshops. By offering courses and workshops over the WWW, universities will be able to reach a new segment of potential students. It also means increased competition if a student can enroll and take a course from any institution on-line. Further research will be necessary to determine the effective components that should be included when designing instruction for the Web.

Instructors need to know if survey and research results are measuring the novelty of the new found convenience students are experiencing by taking on-line courses or are they truly measuring the effectiveness of the instructional value of the features used as teaching strategies in these courses. Courses might be offered and conducted through two differently designed web sites that would allow a comparison of the instructional features. The Web also requires the examination of two issues that should be measured separately. Both synchronous and asynchronous instructional strategies can be useful in web course design, and the value of each is relative to the task it is being used for in the course. Understanding the instructional design and the effectiveness of that design relative to web-based instruction is essential to developing a model of best practices for educators and students.

An Electronic Professional Development Center
and
The Chicago Systemic Initiative

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Abstract: Beginning with 1994, the Chicago Public Schools began a substantial initiative to improve and integrate mathematics, science and technology instruction [Chicago System Initiative or CSI]. This effort resulted in a major, continuing grant from the National Science Foundation. Initially, the project was to focus resources to the local school building by offering many different opportunities for teachers to develop their knowledge and skills. Today, the grant still offers these same kinds and types of services to the local building level and to the teacher. It should be pointed out that the Chicago Public Schools consist of more than 575 individual buildings and more than 26,000 teachers. During late 1996, CSI began building their web page to provide resources for teachers essentially focusing on lesson plans, teaching activities and other ideas. This paper focuses discusses a major revision to the CSI web page and to a major rethinking about staff development.

Background:

Beginning with 1994, the Chicago Public Schools began a substantial effort to upgrade the skills and knowledge of teachers. The focus was on skills and knowledge related to teaching science and mathematics while at the same time beginning to add technology to the curriculum. Substantial work has been accomplished to distribute the content and processes to teachers. The basic model included direct materials distribution to the individual schools. This was largely due to the logistical problems of sending things to buildings with just a handful of professional and support staff. Once the distribution network was established, more individual buildings were contacted to participant in the program with more than 160 schools currently participating in this distribution network. The network is used to distribute supplies and equipment related to science and math. In addition, as technology is becoming available, schools are being connected to the "internet" network. But, much more than the distribution of materials is involved; There is teacher training and development. The general model for dissemination of ideas and teaching processes appears in Figure 1.

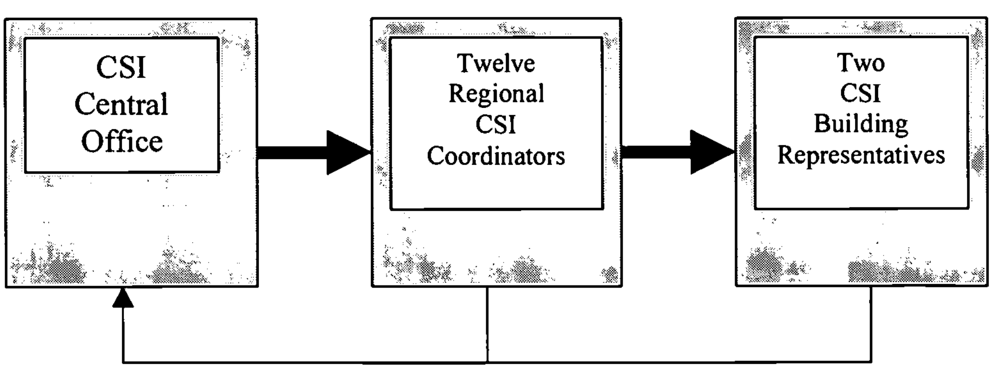


Figure 1: CSI Staff Development Model

A brief explanation is in order to help the reader understand the key features for each of the three elements. On the left, the Central Office staff for CSI consists of the Co-directors, Associate Director and three key professional staff including a person focusing on special projects, a math specialist and a science specialist. In addition, there are a couple of professional development specialists. The middle box includes the key people who are actually in contact with individuals within school buildings. Each of the twelve "regional coordinators" is responsible for about fifteen CSI designated school buildings. Their roles include direct work with teachers by holding staff development activities and assisting the building level CSI representatives with their work. The right hand box corresponds to the individual school building. Within each of the designated CSI participating schools are two individuals responsible for working directly with teachers by providing peer based assistance. These people are the building level CSI representatives. In summary, the model appearing above is a traditional dissemination model (includes the element of train the trainer where the regional coordinator work with the building representatives) and has worked well given the constraints of a large organization. Schools all over the United States use similar organizational approaches to staff development. It should be noted that the initial efforts for technology integration were limited because the Chicago Public Schools had not begun the actual widespread technology installation within the schools until fairly recently. However, much planning has been done to serve a complex system consisting of 575 buildings.

Staff Development:

With the CSI as a background, the paper now focuses specifically on staff development. The National Staff Development Council (NSDC), founded in 1969, is the largest non-profit professional association committed to ensuring success for all students through staff development and school improvement. The NSDC can be contacted by way of the web at www.nsdc.org. It is interesting to note that the "NSDC will provide one-, two- and three-day workshops on effective staff development practices." Certainly, this important resource is one to consider when thinking about and conducting any type of staff development activity. The list of topics, presentations, and consultation areas NSDC can provide is extensive. Figure 2 provides a listing for many of the topics.

- Implementing standards-driven professional development;
- Developing a comprehensive long-range staff development plan;
- Implementing a successful follow-up program;
- Improving student achievement through staff development;
- Making effective presentations;
- Providing staff development to support school improvement;
- Implementing a training of trainers program;
- Facilitating school improvement planning;
- Facilitating school-based decision making through group development, consensus decision making, and effective meeting management;
- Effective staff development practices;
- Evaluating staff development programs;
- Motivating adult learners;
- Implementing change;
- Staff Development 101;
- Resolving conflicts;
- Understanding the changing role of central office staff;
- Maintaining the momentum of improvement efforts;
- Facilitating effective meetings;
- Tools for change.

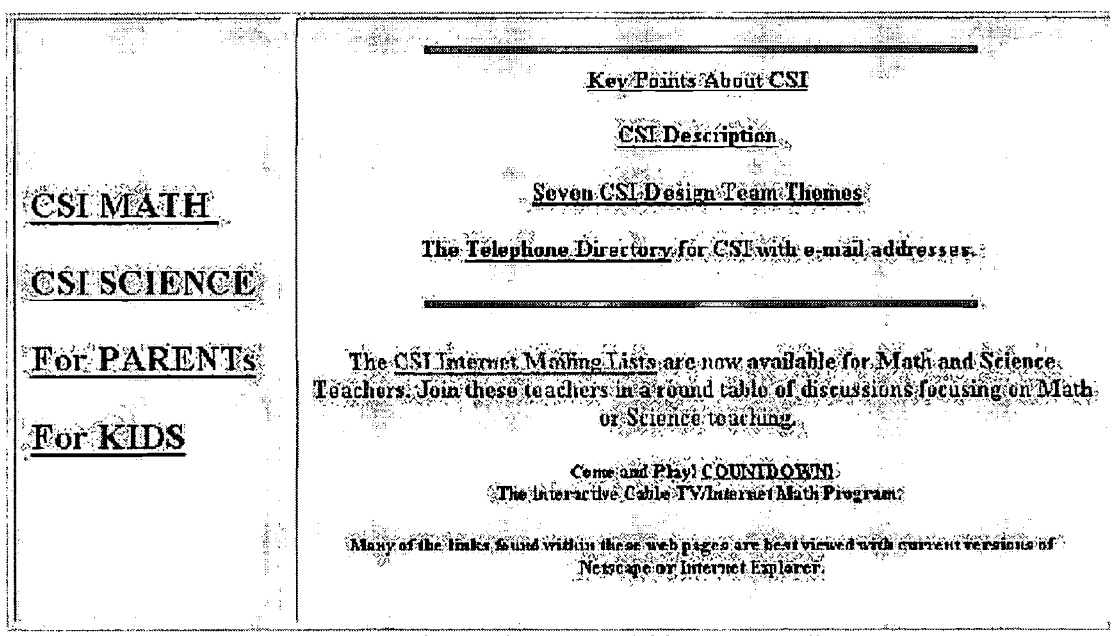
(source: http://www.nsdc.org/services.html)

"Figure 2: Staff Development Resource"

The above Figure shows how extensive Staff Development efforts have evolved during the last thirty years. All kinds of services are available to schools ranging from resolving conflicts to implementing a trainer

the trainers program. This is a wonderful resource for school people along with other professional organizations in the pursuit of improved teaching practices and improved curricular materials.

The problem with the staff development models is that they are labor intensive. That is, this model requires, or even mandates, that school systems spend enormous amounts of resources in the form of professional school people working with professional teachers. There is the direct cost associated with providing staff developers and the cost of teacher time since teachers have to be taken from the classroom. The alternative is to conduct workshops after school and that usually means paying for time to attend the workshop sessions. Figure 2 clearly suggests the nature of this labor intensive business. On top of all of this is the often heard complaint by teachers as to the inappropriate content or that the content does not meet teacher needs. As a consequence of additional funding, the Chicago Public Schools in cooperation with Loyola University Chicago began constructing a world wide web site intended to provide teachers with web based information. The guiding principal was to locate and display as many quality mathematics and science resources as possible which teachers might utilize as part of their teaching. The web page was obviously organized along the lines of math and science resources. In addition, and consistent with parent involvement practices, the web site also provided resources for parents as well. Finally, many high quality student sites were located which were presented to teachers for possible in-class use. To date, more than 40,000 "web hits" have occurred. But, this is only the beginning because until recently few Chicago teachers were web capable in their individual buildings or in their own home. We anticipate substantial increases in the "web hits" over the next year because we are changing the web page, because of increased interest in the use of the web pages by teachers, and better methods for letting teachers know they have their own web pages for important sources of information. As a small but important testimonial, the CSI web page for mathematics was recently cited among the best in the nation ["Road Map To The World Wide Web III" by T.H.E. Journal, 1998, http://www.thejournal.com/].



"Figure 3: Original Version of CSI Web Page"

As evident in Figure 3, Math and Science are at the top of the list for sources of information. In addition, the web links for parents and "kids" is available. There is additional information such as "CSI Description" and the "Seven CSI Design Team Themes" which provides general information about CSI. This web page is currently available at the following web address: http://www.luc.edu/schools/education/csi.htm The structure and organization of this web site is such that if the user clicks on "CSI Math", the user will see several additional choices from which to choose ranging from recommended reading to lesson plans and teaching activities. The web page has remained essentially a text driven tool rather graphics based. This is because of the relatively slower speed machines and modems that teachers tend to have in their homes and at

their schools. Because of the falling prices for competent computers, teachers are buying new machines with fast modems. As such, the next generation of the CSI web page will emerge with more graphics.

Future of Staff Development

Since there is a major change in the quality and price of the computers and their related equipment, the CSI professional staff and the author starting thinking seriously about how to organize the content of the CSI web pages differently. We also thought about how teachers should use the web pages and how staff development might look in the future. An important resource written by George Piskurick focuses on twenty-one trends for the future of training and developing the American workforce. Among the future forces are three that appear to have important relevance to school people. These three forces are:

- Individual responsibility for personal development has become the new philosophy of development specialists. This vast need for programs and opportunities that can be employed on an individual basis will be met through the use of technology development, implementation, and administrative systems.
- Self-directed learning theory will challenge and assist those who work with technology to develop an integrated implementation format that will combine the suitable amount of technology and nontechnology-based learning interventions to meet the needs of learners who have lower and higher levels of internal self-directedness.
- Web-based training through both internal and external Nets will continue to develop and become a standard for technology-based training as problems with bandwidth and speed are solved.

George Piskurick, "Future Forces", http://www.astd.org/virtual_community/comm_learntech/

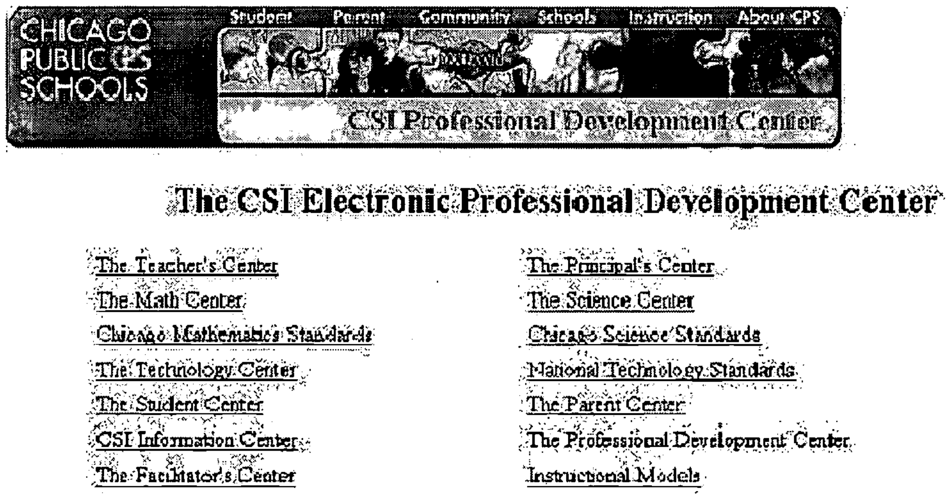
The above three points are important because they help us to re-focus our thinking about staff development. Perhaps the future will place a major responsibility on teachers for their own staff development rather than depending on the school system to provide the service. The notion of self directed learning is especially appealing - perhaps the notion of "just in time training" might be appropriate here. Finally, bandwidth will improve which means that teachers can work from their home machines to receive a host of learning resources ranging from recorded video programs, on-line libraries to locating examples of academic standards.

As summer 1998, approached, the thinking about the web page began to emerge. Part of the change was because of the realization that this web page was intended to serve 26,000 teachers rather than just those who are more or less computer literate. Questions emerged addressing the issues of how best to modify and how best to enhance the web page for teachers. It is obvious that the web can provide the most current information for teachers and it is the most accurate information. More importantly, we began thinking in terms of the future staff development needs.

The use of the web is emerging as the primary source for consistent, standard and accurate information regarding standards based education in the context of mathematics, science, and technology integration as witnessed by the plethora of web based sites addressing these points. By the time you read this, the next generation of the CSI web page will be online and available for teacher use. It will not be complete but, it will be the beginning of the new thinking about web based technology and staff development. The obvious but significant focus here is the use technology to deliver staff development to those responsible for math, science, and technology education. The appearance of the newest version of the CSI web page is found in Figure 4.

Changing the way we think about the web enabled us to change the way teachers can utilize the web. More specifically, the new web page can be thought of as a "just in-time" resource. Namely, the most current information is always available for any teacher who has the need at any moment in time. This is an important advantage provided by the World Wide Web. We also thought about the new web page as being a "Electronic Professional Development Center." This metaphor is taken from the professional development centers run by

many school districts. The concept is, of course, that one of goals of development centers is to provide current information to teachers including curricula, materials and ideas. The "Electronic Professional Development Center" will certainly achieved this important goal.



"Figure 4: CSI World Wide Web Page"
http://www.luc.edu/schools/education/csi.htm

Another aspect of the "Electronic Professional Development Center" is the notion of having all levels of professional educators involved with the center - somewhat like a "town hall" notion. Specifically, the teacher, the principal, the parents, the students, and staff development professionals all of whom can benefit from using the "center". In the "Electronic Professional Development Center" the teacher is clearly the primary target. We added "centers" for parents and students which was described previously. We added the "centers" for the "Facilitators" or "Regional Coordinators" and "Design Team" members all of whom are professional positions at the Chicago Systemic Initiative.

There are a number of important features that will be added in the future. Most noteworthy will be an effort directed toward "on-line" courseware for teachers. Establishing a "Best Practices" location where teachers and facilitators can locate suggestions. An effort will be directed toward building a monthly "spotlight" on a CSI designated school and their respective faculty as well as other similar ideas. Moderated distribution lists/discussion groups have been constructed which enable professionals to send email to their respective specialized groups. For example, principals will have their specialized distribution lists to enable them to share ideas and suggestions about such things as how mathematics, science and technology can be integrated. Similarly, distribution lists for other groups will be developed to encourage the sharing of ideas and suggestions.

While an urban area appears to be relative small in geographical miles, it interesting to note that an individual teacher can feel particularly isolated in a professional sense. This is especially true when one considers that there are so many teachers involved in an educational enterprise known as the Chicago Public Schools. Therefore, the first goal for the "Electronic Professional Development Center" is to provide current and accurate information. The second goal of the "Electronic Professional Development Center" is to become an electronic meeting place for the exchange of ideas and approaches to educating children. Both of these goals will be presented in the context of the "just in time" model for professional development of teachers. The information is available when they need the information. Further, the professional educators can meet using the "electronic town hall" concept to discuss and exchange points of view and ideas. The third goal is to move to "on-line" learning which begins to addresses George Piskurik's ideas. The third goal will be the most challenge to achieve.

One of the primary criticisms of the "Professional Electronic Development Center" will be the lack of an actual person to talk with and to discuss ideas. This might be true, however, we think that this might be offset

by two dynamics. First, we think that dollars will be saved with an "electronic" form of the professional development center. Second, we think that the information provided to the various groups as represented by the different "Centers" will be of highest quality. Consequently, the professional educator will be somewhat more willing to overlook the lack of a specific contact person in favor of consistently good material as we teachers move toward being responsible for our own continuing education.

Summary

The Chicago Systemic Initiative is just beginning their work toward the new concept for delivering staff development services and we recognize there will be many important and significant concerns expressed by the teachers. Further, we recognize that this effort will be incremental in nature. Maybe it might be best to look back from the future to see what this will look like. Just to name a few things, the teacher will be able to focus their own learning relative to staff development. These activities will range from colleges and universities offering and delivering new kinds of courses sent right to the home of the teacher [time and environmentally friendly]. The teacher can meet on-line regularly and, in person. The teacher will have access to the most current district standards and policies. The teacher will be as well informed as any official of the public school system or any other peer which helps to eliminate the sense of isolation one experiences within the context of a large urban setting. The teacher will be provided information for parent relative to his/her students which parents can use. This new form of staff development is a completely flexible system that can be custom designed to meet the specific needs of the teacher exactly when the teacher needs the information. But, we should not be misled. With this flexibility goes responsibility for one's own destiny. That means the teacher must work to set learning goals and performance standards to improve their own teaching. It will not be an easy time as there will be many criticisms. As a benefit of this work, the new staff development system will produce substantial improvements in student outcomes and learning.

This article has highlighted a different way of using the World Wide Web. In particular, the web is being used to serve as an "Electronic Professional Development Center" which provides high quality and accurate information for professional educators. It can also serve as a "town hall" where folks with common interests can meet and exchange questions, solutions and ideas. Much more work remains. But, this effort represents a new way to look at the delivery of professional development services to the classroom teacher. It is anticipated that next year, a report will be available describing progress toward the goal of using technology for purposes of staff development. It is an exciting time and requires individuals with the most imaginative and creative ideas.

The After-Training Support: Using Internet Technology to Help and Connect In-Service Teachers in Their Teaching and Professional Development

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Abstract: For the last decade, the movement of bringing computer technology into the classroom has been a focal point for many institutions and organizations. In summary, the mainstream of this movement has gone through the first two phases of obtaining equipment and the computer literacy training (Hunt & Bohlin, 1993; Marcinkiewicz, 1994), and is currently undergoing a third phase of technology integration training (Hu & Nelson, 1998; Lan, 1998). This paper is to discuss another phase that follows the integration training: the phase of the after-training support -- how important this phase is to ensure the success of the aforementioned three phases to be carried on into everyday teaching, how to use Internet technology to implement this key phase, as modeled in the website of Health and Sciences Technology Academy, and the effectiveness of the implementations.

The Four Phases of Technology Integration

Bringing computers into the classroom started with introducing computer hardware and software into schools, and providing teachers with computer literacy training. There is a strong growth in use of technology by schools, and the expanded penetration of computers in schools is continuing, in forms of adding equipment and developing connections to the national information infrastructure at a high rate (1996, Glennan & Melmed). Early technology-related training to teachers was limited on the computer literacy training. The focuses were on how to operate computer, and how to use general-purposed software such as word-processor, spreadsheet, e-mail and web browsers.

In the past 3 years, as the technology integration movement outgrew its infant stage, more and more attention has been paid on technology integration training, which differs from the computer literacy training in that integration training focuses on appropriate usage of technology in content area curricula rather than on general usage of computer hardware and software (Hu & Nelson, 1998).

Every year, especially during summer sessions, groups and groups of teachers go through technology training workshops to learn how to use computers in their teaching. Typical workshops are intensive training that lasts for one to four weeks. Such training is enthusiastically welcomed by the teachers, and post-test survey results are usually very encouraging: teachers reported that they had learned a lot, they had networked with other teachers, and they were planning to integrate the knowledge and skills they acquired in training once they got back to school. But a disturbing question for many training providers is "what happened after that?"

In many cases, most of those positive results of the workshops dissolved soon after the teachers left the training session. What went wrong? Why the positive attitudes were not sustained? Why planned projects were not carried out? Why the full potential of the program did not get realized?

The reasons behind such a phenomenon are from many aspects. In earlier stage of technology integration, we attributed the failure to the lack of equipment when there were not hardware and software in place for teacher to use. Yet the proliferation of equipment in recent years did not bring the corresponding increase of technology integration. The RAND/CTI workshops on professional development and technology-assisted effective schooling suggested three common requirements for continuing professional development: (1) adequate time for teachers to acquire skills and to plan the program and activities; (2)

assistance that is keyed to the needs of the teachers and provided at the times when they need it; and (3) a clear vision concerning the purposes and the educational goals that guide the program of the school and classroom (1996, Glennan & Melmed).

The second requirement is in accordance with our notion of emphasizing the after-training support, which is one of the key issues that need to be addressed to ensure the positive effects of the technology training to sustain, and the knowledge and skills teachers obtained in the training get utilized in their everyday teaching. It is time to add another phase – the phase of the after-training support -- after the third phase of technology integration training.

Some well-designed technology training programs have already started to implement the after-training support. It can be done in different fashions such as on-site visit, mailing, listserv, e-mail, phone trouble-shooting, and tele-mentoring, etc (Lan, 1998). This paper is to discuss the use of various Internet technology to support and connect in-service teachers in their teaching and professional development after the training sessions, as modeled in the Health Sciences and Technology Academy Program, which is affiliated with Robert C. Byrd Health Sciences Center of West Virginia University.

The HSTA Program and Its Special Needs for After-Training Support:

The Health Sciences and Technology Academy (HSTA) reaches out to 9^{th}-12^{th} grade under-represented students and follows them to college and towards professional school to help them prepare for health care careers. Our goal is to nurtúre the ambitions of talented students who, for economic or other reasons, might not ordinarily achieve these career goals. HSTA is a partnership among the numerous units of West Virginia University and many Appalachian communities.

The program brings minority and disadvantaged students and their teachers to campus each summer for clinic, laboratory, and classroom training and enrichment activities, then provides the infrastructure and support for community-based science projects mentored by teachers, health professions students and volunteer community leaders during the school year. HSTA aims to share the resources and talent of the University, to encourage public school teachers' and community leaders' mentoring of students.

The ultimate goal of HSTA is to increase the college-going rate among under-represented students in the Appalachian region, to improve science and math education, to empower communities through leadership development of their youth, and, ultimately, to increase the number of health care providers in West Virginia's currently under-served rural communities.

Currently HSTA is in 20 counties of the State of West Virginia, involving 460 students and 48 middle and high school teachers. 100% of the graduating 4^{th} year HSTA students applied to college and were accepted. For professional development, 5 HSTA teachers graduated with a Master degree in secondary education in 1997 through HSTA, and over the next two years, 8 more such teachers will graduate.

The challenge of HSTA teacher training and professional development is that the only chance for face-to-face sessions are the 4-week summer workshop, and a two-day fall workshop each year. The workshops are focused on how to integrate technology into teaching and HSTA club activities. For the rest of the year, teachers are located across the state in their local HSTA clubs to facilitate student projects related to health sciences and technology. How to provide support to the teachers in their teaching and professional development, and how to connect teachers and students across the state become a key issue for the successful operation of HSTA program.

Goals of the After-Training Support Website:

Through task analysis and interviewing with teachers and field site coordinators, we defined the major goals for this support website is to

1. Provide quick case-based tech support for teachers on computer hardware/software problems.
2. Provide guidance and suggestions on curriculum and activity design and technology uses.
3. Build a cyber-community for the HSTA participants. Provide a forum for teachers, students and field site coordinators to network with each other, with content experts in health science and education, and with the HSTA central administrative office.
4. Provide selected quality resource links on the Internet related to health sciences, science education, and technology integration.
5. Showcase teacher projects as well as student projects. Reinforce the sample curriculum and activity design and the appropriate use of technology.

Internet Technology Used in the After-Training Support

Asynchronous and synchronous communication: The WebBoard software by O'Reilly is an excellent tool to facilitate asynchronous and synchronous communications. These two types of communications are usually hosted by separate software. Bulletin board is used for asynchronous communication in which users log on to the bulletin board and post messages, waiting to get a response from other users when they log on to the board and read the message in a different time. Chat software is used to facilitate the synchronous communication in which users log on to the chat room at the same time, and communicate back and forth by typing messages. WebBoard is a seamless combination of both: it can be used as a bulletin board where users can access in different times and locations to post and response to messages to the board, and it is also used in many sites as a chat software, including major sites such as NBC.com Forum, Dell Talk, and ZD Net. WebBoard combines both features by using conference rooms. Each conference is a posting board with its own topic, and a chat room is attached to each conference. The combination of the posting and chatting features makes the online communication easy to use and to manage.

In HSTA website, we set up conference rooms for four categories of topics. One for curriculum and club activity development, topics in this category include air quality, concept mapping, generic engineering, health career experiences, human nutrition, inquiry and discover activities, science projects, tobacco and health, water quality, and UV radiation. Another category is for tech support for software and hardware, such as Tips and Tricks, and Tech Support, where messages on how to make better use of software/hardware, and Q&As on software/hardware problems are posted. The third type is for management, such as announcements, and conference for field site coordinators where they can discuss administrative tasks, and the fourth type is used for supporting graduate courses provided to HSTA teachers for professional development through College of Human Resources and Education of West Virginia University.

Another feature of WebBoard is that more than one board can be set up. In HSTA site, we have one board dedicated for the teacher use, and we are in the process of setting another board for student use. The student board will allow students to log in and communicate with others in project collaboration. Separating the two boards makes management of the posting and chatting easier. Moderating features for the posting and chatting are available if necessary.

Besides these two boards for different user groups, other boards have been used for specific collaborative projects. The current project board is the one dedicated to the UVB project, facilitated by one of the HSTA curriculum coordinators, Jenny Bardwell. In this project entitled "UV Rays and Global Change" (http://nt-hsta.hsc.wvu.edu/health/uvproje/nebulae.htm), students of the HSTA clubs across the State of West Virginia gather daily data on UV-B intensity, and post the daily readings to the WebBoard. The data are then entered into the database for future analysis, and currently the curriculum coordinator is working on putting the UV-B readings on the West Virginia map so that the map can be used by TV stations as part of their weather reports. Other related discussions to the UV rays and collaboration activities are also hosted on the board. The future direction of this project is to network with the teachers and students from other locations across the nation, or even across the world to collect and analyze the UV data. WebBoard can be used to facilitate the online communication of large-scale collaborative activities.

Connect Teachers, Students, Health Science Professionals, and Other Content Experts. The HSTA website is not just a tech support site for instructional technology and science and health education, it also serves as a connecting mechanism that brings the expertise and knowledge of the teachers and other professionals together by using database-generated web pages.

In the process of facilitating the student-centered science projects, one of the issues that trouble the teachers most is their worrying about "what if the topic of investigation is out of my scope of expertise?" "How much time I have to spend to research for the answer?" "Where can I find help?"

An "Ask the Expert!" website is a possible solution to those questions. This website listed profiles of volunteered health science professionals from the medical school of West Virginia University, and other experts in science education and some other areas. The profiles have a brief introduction to the experts, including the specialty areas and the current research interests of these experts, as well as their e-mail address. When teachers and students run into questions in their investigation, they can look up the profiles, and find experts specialized in their problem area. By contacting the experts through e-mail, they can get suggestions back from them soon.

Because the expert list keeps growing and changing, updating the expert web pages becomes a time consuming task for web site management. Each time when a new expert comes in, a web page has to be

created for the individual, and a new entry has to be added into the index which is sorted according to the last name of the expert, and by the keywords of their specialty areas. To make fast, easy and accurate update of expert profile web pages, Microsoft Access is used to help with creating the web pages. When a new expert turns in the application form provided by HSTA, all the information on that form is entered into an Access database. The database is programmed by the website manager so that HTML code of the webpage for the new expert is automatically generated, and is added into the site. This use of database makes site management more efficient. It is not only applicable to the update of the expert record, but also makes the change on webpage layout design more flexible. For example if one link has to be added on each expert's page, instead of going to each expert page and add that link, all the site manager needs to do is to adjust one line of code inside of the database and click an "update" button. Each of the expert web pages will be updated to use the new format in a snap. Using database in webpage creation makes update and expansion of the "Ask the Expert!" feasible.

With similar approach, currently a new database is being built to create a site called "Ask the Teacher!". This site aims to create connections and encourage collaboration within HSTA clubs. A webpage is created for each HSTA teacher, highlighting the teacher's specialty areas and the projects the teacher facilitated. We hope this will help teachers to share valuable experience and information with each other and with the HSTA students.

Other highlights of the support site include the showcase of student projects, lesson plan posting, resource links on technology integration and science education, and annual science fair organizing.

Evaluation:

HSTA is currently in the process of design surveys on teachers' use of the HSTA website. Based on the five goals of the HSTA website, the questionnaire will ask the teachers in what degree the website achieved the five goals in providing support for their teaching and professional development. The questionnaire will also include open-ended questions to collect suggestions from teachers on how to make the HSTA website more useful and user-friendly for both teachers and students.

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What Really Happens in Classroom Internet Projects

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Abstract: One of the difficulties with Internet projects is finding out what actually happens in real classrooms that participate in the projects. Generally, we hear the hype about the project but not the reality. Projects that sound good might have few participants or no participants, or they might be poorly coordinated. This paper presents preliminary results of an ongoing study in which teachers whose classes participated in Internet projects are asked about the successes and failures of the projects for their classrooms.

1. Introduction

Teachers use Internet projects with their classes for a variety of reasons. Some have broad objectives, such as adding a technology component to their curriculum or motivating their students. Others have specific curricular objectives. In many cases, broad or specific objectives are met by Internet projects, and in many cases they are not.

In this ongoing study, I am communicating with teachers who have participated in Internet projects with their classes. The classes range from K-12 and include public and private schools, single-grade and multi-grade classrooms, and regular classroom teachers and resource specialists. I am specifically looking at three Internet projects: The World Weather Watch (http://youth.net/weather/), Signs of Autumn/Signs of Spring (Signs, http://www1.minn.net/~schubert/ssf/), and Global Learning and Observation to Benefit the Environment (GLOBE, http://www.globe.gov/). Each has students observe the environment as the seasons change. World Weather Watch and Signs require little or no training and a minimal commitment of time and effort on the part of participating classes. GLOBE requires teachers to attend training for five days, requires daily measurements that conform to scientific protocols, and requires approximately $500 of equipment.

In World Weather Watch, students gather sunrise/sunset times, high/temperatures, and a general description of weather conditions each Wednesday during the project. This information is shared with all participants. Additionally, each class is paired with a partner class in a different climatic zone, and partners email their data to each other. A discussion board is provided at the project web site for group discussions. World Weather Watch is open to students in grades K-12, but over two-thirds of the participants are in elementary classrooms.

In Signs, students make weekly observations about the changing seasons for four weeks in the fall or spring. Observations, stories, and pictures are sent to the project coordinator who compiles an electronic magazine (e-zine) each week. Students compare their seasonal changes to others by looking at and discussing the e-zine. The project also suggests several extension activities to supplement the observations made. Signs is open to classrooms in grades K-6.

In GLOBE students collect one or more types of data on a daily basis according to specific scientific protocols. Weather data, for example, must be collected at solar noon each day, including weekends and holidays. The data is posted to the GLOBE web site and can be viewed by participants in various formats, including scientific visualization software. Participating teachers are given an "Implementation Guide" with a variety of learning activities and protocols for collecting and using the data. GLOBE offers opportunities to discuss the project with scientists who are using the data. GLOBE is open to classrooms in grades K-12 and includes lesson plans and activities appropriate for all grade levels.

Overall, participating teachers were very happy with the projects. Most reported that their objectives were and they hoped to participate in the project again. Nearly all teachers reported some problems. Some of the problems were viewed as obstacles to overcome and others interfered with some or all of the objectives of the project. In this paper, I describe some of the obstacles and successes that the teachers encountered.

2. Methods

This informal qualitative study involved sending electronic mail surveys to participants in each of the three projects studied. The questions were modified for each project to include one or two questions that related to the specific project. The questions asked of GLOBE participants were: "How did you find out about the project? What were your objectives for participating in this project? Were they met? Did you have any problems? What did you do with the data that was collected from your class and from the entire project? Did you participate in any of the Learning Activities? Have you participated in this or other Internet projects in the past? If so, which projects? Did your students benefit from the fact that the data was being used for real scientific purposes, or would it have been just as beneficial to have participated in a data collection project that was not linked to scientific study? Was the project worthwhile for your class?" As results were received, each respondent was sent an electronic mail message of thanks, and some respondents were asked follow-up questions.

For World Weather Watch, 5 out of 9 teachers surveyed responded. World Weather Watch includes approximately 70 classrooms each session. World Weather Watch was used as a pilot for this study. I was concerned that teachers would be disturbed to receive unsolicited email. I was pleased to find that no one who responded complained about unsolicited email, and many were pleased that I had found their work on the web (and disappointed that more people had not sent them email about their project).

For the Signs Project, 12 out of 29 teachers responded to my survey.

For GLOBE, 59 out of 237 teachers surveyed responded. GLOBE includes hundreds of teachers from the United States and all over the world. About one-third of GLOBE participants in the United States were surveyed. No participants from outside the United States were surveyed.

The respondents to the survey do not reflect a random sample, and the responses are not used for any statistical analysis. Those responding are more likely to be technically savvy (at a minimum, they must have entered correct email addresses for the project, and they must have read and responded to an email message). Many of the respondents were excited to share their success stories so those who were unsuccessful with the projects might have been less likely to respond. Responses from participants were analyzed for common themes as well as unique stories to serve as a roadmap for the possibilities and the pitfalls a classroom teacher might encounter when undertaking an Internet project.

3. Obstacles, Issues, Problems, and Successes

The vast majority of teachers reported that the project in which they participated was successful, meeting or exceeding their expectations. As one GLOBE teacher reported, "The GLOBE program has surpassed my original expectations, which were to have students participate in a project that would represent real science, doing what real scientist do.... The extra benefits we have reaped: my students have participated in GLOBE chats with the real scientists, we have downloaded information from our own archives which has enabled us to see patterns about how the earth's systems are connected, we have also used our data to make predictions concerning El Nino weather patterns."

Most teachers reported problems along the way. Some of these problems were obstacles that were overcome while others limited how well the objectives of the project were met. Problems fell into five categories: time and management, technology, curriculum, communication, and other. These categories are not strict and many overlapped, but they help give a sense of the kinds of problems teachers encountered.

3.1 Time and Management

Time and management problems were the most commonly reported problems. These included problems of not having enough time for the project, not having the appropriate time for the project (e.g., temperature readings needing to be taken at a certain time that did not coincide with class time), and general issues of managing students as they did the project.

Both World Weather Watch and GLOBE required readings to be taken at specific times (temperatures at solar noon, for example) or on specific days of the week. In addition, GLOBE weather readings were required every day, including weekends and holidays. This was a burden for many teachers. As one GLOBE teacher

reported, "It has also been difficult at times to collect data on the weekends. Students are not always able to come in since their families have other activities on the weekends (like soccer games that are also occurring at solar noon)." Another GLOBE teacher who could not have readings taken over the summer was disappointed because she thought the summer readings would be beneficial.

While many teachers reported problems with collecting data regularly, some viewed this as an opportunity to teach responsibility. One teacher, whose class missed very few days over a two year span of taking measurement for GLOBE, reported that her success was due to her emphasis that science included making sacrifices. In addition, she offered extra credit for weekend and holiday measurements. Other GLOBE teachers found that using more experienced students and parents as helpers alleviated the burden on the teacher: "So that we don't all have to go out to the weather station each day, I have trained two former science students, upper classmen, who come to my two Earth Science classes and take two kids out to the weather station to do the measurements, then to the multi-media lab to enter the data.... It works perfectly. During the summer, I train parents to take over, so I can take a break. On weekends during the school year, I record the data, since I live only 3 miles from school." One GLOBE teacher found that this helped raise the self-esteem of the student who was helping out.

Other teachers reported a more general concern for lack of time, fitting the project into an already packed day. As one GLOBE teacher stated, "My only problem has been finding enough time! (Isn't that everyone's complaint?) Our schedule is so packed (5th grade) and there are so many extra programs they are supposed to participate in: DARE, Jr. Achievement, Here's Looking at You 2000, H.E.A.T., Ropes, etc."

Because of the flexibility of the curriculum, many specialists and resource teachers found Internet projects to be worthwhile, but specialists had the problem that they did not see the students regularly enough.

Many of the time and management problems limited the impact of the project, often to a few students. This was due to schedules that did not coincide with the time for taking readings and the fact that an entire class does not need to go to a weather station to take a single temperature reading. Some teachers used rotating schedules so different groups of students took readings each day. In one case, more than one group took readings each day, but only one group's readings were "official" and used for the project. Other teachers simply limited who could participate in the project. A GLOBE participant responded: "The major concern I have involves the actual number of students who participate in the program. I begin the year training all of my students how to perform the atmospheric protocols.... The protocols must be completed during solar noon. Only three of my five classes take place during the prescribed time.... My other problem is that it doesn't take 30 students to perform the protocols."

Management problems were not limited to managing individual classrooms. Many schools or grade levels that tried to use a project with several classrooms had difficulties in managing groups of teachers. One school tried to integrate the GLOBE project into four fourth grade classrooms. This created some problems because not all the teachers were interested in the program. One teacher reported that "not all teachers felt ownership and therefore not as invested; some teachers believe too difficult for 4th graders; some teachers believe too difficult to manage; some teachers believe too time-consuming (GLOBE plus regular science curriculum)." This teacher found solutions to problems for her own classroom, but teachers who were not as interested in the project were not as willing to find creative solutions.

3.2 Technology

Problems and difficulties with technology were common. However, teachers chose to participate in the projects with a basic understanding of the technological needs of the project, so technology problems were mainly obstacles that teachers found ways to overcome. None of the projects required computer technology more advanced than simple email and world wide web access. Problems included a lack of an Internet connection in the classroom or school and difficulty transmitting information in the appropriate format.

In World Weather Watch, information was exchanged with partners via email. One teacher's partner class chose to send an attached file with the students' messages. This teacher could not read the attached file. Solving this problem took several weeks to solve. This limited the class's ability to establish an pen-pal relationship.

A participant in Signs had difficulty submitting pictures, "My main problem was my inability to know how to send pictures. The computer technician at my school put them onto a disk for me to transmit from home, but they never got to wherever they were supposed to go."

Many teachers reported that their classrooms were not hooked up to the Internet. Most solved this by finding other computers in the school to send data or by sending data from home. This worked out well for the

technical needs of the project, but some teachers found that it separated their students' from the project. One Signs teacher reported, "I went into the project knowing that our school didn't have Internet access in any place except the principal's office. I knew that that I would be responsible for uploading the information from home and that was okay. I thought we would have more time to examine other schools' work in the central office but it took so long to do this that we could only view our own work twice and we didn't view the work of other schools at all. So I guess the children felt a kinship with other students completing the project knowing that they were part of the group but they never saw the other students' work."

A GLOBE teacher reported that he found the students got more out of the project after the classroom was hooked up to the Internet, "Last year I was taking the data home and sending it on my home computer. This year we are on line at school..... The students have much more ownership this year. Each child gets to enter the data and then we print out a copy of the completed sheet for them to take home to show their parents. They are amazed that their data is instantaneously sent to Boulder, Colorado."

While entering data at home worked well for some teachers, one GLOBE teacher could not always keep up with the data entry, "I did not have a computer with the Internet in my classroom and have had to enter the data by myself. I was not able to do it consistently even though the data was being taken."

Some teachers found that students could help them with technological problems. For example, "The first year I taught GLOBE I had two wonderful students who were very strong in science (they also were good on the computer).... I was having trouble at first logging on. They read the instructions and figured out which number was our code and which was out password."

3.3 Curriculum

Teachers find more success with projects when the projects match their curricular goals or when their curricula were flexible enough to change to the objectives of the project. Whenever technology is viewed as an add-on to the curriculum and not integrated with the curriculum, it becomes an extra burden.

Several teachers found that the projects helped organize and extend their curricula. One GLOBE teacher responded: "I don't find that GLOBE detracts from my curriculum since I determine what is in my curriculum. As a matter of fact, it has helped me organize my ecology curriculum around a central theme."

Other teachers found that the projects were worthwhile, but they did not meet their curricular needs. This was most apparent with a teacher who was looking for something very specific that Signs did not provide. His objective was for his "students to discover that kids in the southern hemisphere were reporting increasing temperature/hours of daylight, and corresponding changes in plant activity" while his students were reporting the opposite in the fall. He was disappointed that the semester he participated in the project, there were no participants from the southern hemisphere.

Others found that the projects met many of their personal objectives, but they had to first fulfill specific school, district, or state objectives. This limited the amount of time they could dedicate to the projects. Many teachers found success with the projects by finding ways that they could be used with their existing curriculum. This did not provide a great deal of time for the project, but teachers found success by applying the projects to the curriculum.

Different teachers found that the projects were more appropriate with different grade levels. GLOBE offers learning activities for students in a variety of grades, but many teachers found that younger students had trouble understanding the importance of the data, and one teacher reported that older students were bored, "Younger students (participation ranges from 3rd to 10th grade) had difficulties not only in taking measurements but in understanding the significance of the measurements; some older students became bored with the repetitiveness of taking the same daily measurements."

A few teachers reported problems with students as young as 3rd and 4th grade understanding the significance of the GLOBE data, "This year I have a straight Third Grade class. In my opinion, they are a little young for most of this program.... For these reasons, I am turning over the program to a Fifth Grade teacher here at my school.... These 3rd graders are still very focused on themselves." One 6th grade teacher found that his students had similar problems, "I often wonder if they are able to make connections from their experiences to the use of their submitted data. It tends to get lost once it is typed in. I have not been successful in pulling back their data and comparing it to other GLOBE sites." Other teachers, at various grade-levels, simply felt that the GLOBE program was not appropriate for their grade level.

Many teachers were struggling with issues of making global connections and connecting the data they were collecting to how it was being used by others. Other teachers felt that making the global connections was

the real benefit of the projects. "Previous to GLOBE our school had participated in a weather data collection project sponsored by a local television station. The station uses the data for forecasting and reports which school is supplying the data, but the students felt that the GLOBE program had a larger impact due to the greater number of schools and people involved."

A kindergarten teacher found that Signs could help her teach concepts that are difficult for her students, "Everyone is not having the same weather at the same time. Kindergarten children have a hard time with concepts like that."

3.4 Communication

Issues of communication were a problem for some teachers. This was true World Weather Watch in which classes were partnered with other classes. Partnering provided great benefits to participants with active partners, but those benefits were limited in some cases by partners that did not keep up their communication.

A World Weather Watch participant commented that communication, including an electronic discussion board and email with the partner school were beneficial, although not all schools took full advantage of them, "It was nice that she included a partner school and a place to share. You always hope that people take advantage of the sharing, but this is a new medium for teachers."

The organizer of the World Weather Watch project expressed her concerns about participant sharing. She was hesitant to match classrooms with partners, but she felt that the benefits outweighed the risks, "As with any free endeavor, there was a certain amount of attrition. In many instances, I was informed via email that a class would not be able to continue and I was then able to rematch their partner class. In other instances, the class left high and dry chose not to be rematched but rather to just use the weekly data on the page for their in class activities. I spent many hours trying to decide if I wanted to match classes for this very reason and decided that with having a partner school came a little more commitment." Since the project was free and easy to join, not all schools felt the same commitment that they might if they had paid to join the project or paid for expensive equipment. This created some frustration when partners dropped out of the project.

3.5 Other

Many other problems occurred for some of the teachers. Projects had fairly strict timeframes and schedules, as do schools. When these schedules are disrupted by problems, Internet projects might not work. The most serious problems were expense and equipment security. Although none of these projects had a registration fee, the GLOBE project required approximately $500 worth of equipment to take proper data readings. Many teachers found support from their schools and districts. Others sold popcorn.

Security of the equipment became a problem for many teachers. Even locked equipment was occasionally stolen or vandalized, as one GLOBE teacher reported, "Another problem we encountered was vandalism. Our station is locked, but one of the students didn't lock it securely and another student took one of the thermometers and hid it.... This year our rain gauge was smashed even though it was within a brick wall."

For every problem with Internet projects, some teachers find it limits the usefulness of the project and others find solutions or view the problem as an opportunity.. Almost every teacher reported some kind of problem with every project, but most of them found ways to be successful despite (or sometimes because of) the problems.

3.6 Successes and Interesting Solutions

While many of the teachers found that the basic requirements of the projects were enough for their classes, many teachers found creative ways to use the projects. One Signs teacher reported:

> Rather than measure weather patterns and temperatures, etc., I had my students observe specific sites around the perimeter of our school. By focusing their attention on specifics, they could observe changes in those things with the possibilities in how the changing weather or other variables affected them. We photographed the individual areas on our initial nature walk and took notes about what we observed. Subsequent walks were usually photographed...and...documented.... I used a digital camera to photograph

the walks/sites and students' artwork and uploaded the pictures to my classroom computer, edited them and put them into a looped slide show. I put the computer in the school hall outside my classroom to share our work with the rest of the school....

After our walks, we would draw our illustrations (if not completed in the field) view our photographs, then share our work with each other as we held conferences about what we had observed.... Problem solving skills were used to predict future expectations based on what had been learned....

Long after the completion of the project, on a sunny June day as we marched around the block in a Flag Day celebration, my little scientists were *still* calling out to me things like, "Look, Mrs. G.! The rose bush is now in full bloom and I see bees landing in it for a drink!" And, "Oh, look! The bird nest is falling down and is empty now." A positive sign for a happy, successful learning experience."

In the GLOBE project, data is collected and used by scientists around the world. Almost all the teachers in GLOBE reported that it was beneficial that real scientists used the data. It helped to motivate students, to give them a feeling of real purpose, and to make them take pride in their work and be more careful in taking accurate measurements. This was true for gifted and talented students as well as underachieving students. "I think it has been a real motivator. As with the other field study projects we're involved in, students take on a more serious demeanor and have a high *proud* factor as they collect data for a purpose.... At least with my students who are gifted and talented, just doing an exercise without any purpose is a real turn off." "I feel they have a sense of responsibility and that they have contributed something worthwhile in a way they never could before.... Just being able to participate has bonded my students, who have heretofore felt worthless and incapable in academic areas, together to provide a sense of pride, belonging, and contribution to society."

Of course with an attitude like this, it is hard to fail: "All my involvement with ... technology-related work in the classroom for students is worthwhile, even if the project doesn't work out. I like to explore new challenges and opportunities in these areas to take risks and see if the chances I take (academically) can make me a better teacher.... Mistakes are challenges to be overcome."

4. Conclusion

Technology can be very beneficial, and it can be intimidating and difficult to use. Anyone who attempts to participate in an Internet project is sure to run into problems. Simple projects, like the World Weather Watch and Signs, and more complex projects like GLOBE had their share of problems. The Internet does nothing for education on its own. Creative and dedicated teachers find ways to use the Internet to expand their classrooms and enhance their curricula. Obstacles with time and management, technology problems, mismatches with existing curricula, personal communication, and expense can all be overcome to create a powerful learning environment. But teachers must understand that it is their hard work and dedication that will be necessary to overcome these obstacles. This paper provides a guide to some of the problems and successes that several teachers encountered while expanding their classrooms to take advantage of telecommunications projects.

EDUC 541 Goes On-line

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Abstract: This paper focuses on graduate students' responses and reflections on the required use of the Internet to complete assignments for an on campus research course. Students' responses to feedback forms, email assignments, and conversations with the instructor were analyzed. Materials and activities are gradually being designed and developed to enable the entire course to be delivered over the Internet. Students enrolled in on campus sections of the course during the Fall and Winter quarter are providing feedback for the further development of the course materials.

State and university initiatives to develop distance education courses, encouraged faculty to identify courses to be delivered using either compressed video or the Internet. Once courses were identified, summer grants were available from the University to facilitate faculty in the development of courses for distance delivery. One of these grants was used to begin the development of web-based materials to place EDUC 541 - Introduction to Graduate Study and Research on-line. It was proposed that the materials for the course be developed over the summer of 1998, field tested during the Fall and Winter quarters (1998-1999) using students enrolled in on campus sections of the course, and further refined over the summer of 1999 with the intent of offering the complete course on-line in Fall 1999. This paper chronicles the field testing of the materials during the Fall 1998 quarter using students' email messages, responses to on-line feedback forms, and personal conversations with the instructor.

Development of the course materials followed the instructional design stages advocated by Willis (1992) which include: design, development, evaluation, and revision. As the materials were designed and developed, care was taken to lessen the chances of students becoming lost in the hypertext on the screen (Jih, & Reeves, 1992; Park, 1991; Saga, 1992). This was an important consideration because it was anticipated that the students would have a variety of technical skill levels and prior experiences with the Internet. Once students successfully access the materials, they must develop mental models of the content to understand how the material is presented in the hypertext environment (Jih & Reeves, 1992; Park & Gittelman, 1995). Students who do not develop an adequate mental model of the web site can become confused and disoriented as they search the hypertext documents.

Well designed on-line course materials can promote improved student learning by appealing to students' learning styles, providing flexible learning, and encouraging learning in a variety of ways (Owston, 1997). Web sites can provide stimulating, interactive course materials, such as links to course-related sites and sample tests to take. Projects and activities that students can complete at their own pace and at their convenience give students flexibility in their learning. Further, Owston contends that web based learning enables students to learn using critical thinking, problem solving, written communication, and collaborative activities.

The development of the course materials involved a team approach, as advocated by Hoffman and Ritchie (1998), to assure a variety of technical expertise as well as a support system. The first author contributed the course content, while the second author worked on the design and technical aspects of the web based materials. However, as the collaboration continues these roles become less distinct.

Barriers to accessing on-line course materials include: malfunctioning hardware, configuring software to access the Internet, slow or down servers, busy signals, lack of access to computers (Owston, 1997; Ross, 1996). Hence, technical support from the instructor and the university is an essential

component of an on-line course. Barriers encountered when accessing and using the on-line materials cause students to become frustrated and may interfere with their learning content.

Methodology

Students enrolled in the course were required to access the course web site to examine course materials, link to course related sites, download files, and complete feedback evaluation forms.

Participants

The sample consisted of 16 graduate students enrolled in EDUC 541 during the Fall Quarter of 1998. They ranged in age from 22 years to mid 50s; including 9 females and 7 males. All of the students were working on masters degrees; four students were working on degrees in health and wellness; seven students were working on masters degrees and teacher certification; two of these seven had retired from other professions and recently started teaching.

Instruments

Instruments used to collect data included researcher developed pre- and post-feedback forms, email messages, and student conversations. Feedback Form I consisted of seven questions. The first five questions dealt with information on the computer system and Internet browsers students were using as well as how they were accessing the site. Question six dealt with the ease of finding materials on the site, and question seven asked if they had taken any other courses requiring them to use the Internet.

Feedback Form II contained the same questions as Form I with 12 additional questions. These additional questions focused on difficulties they encountered, usefulness of the content, ease of use, would they take another course requiring web access, and would they take this course completely on-line. Students were asked to elaborate on their responses to these questions.

Students were required to complete four email assignments. Email assignments one and four were to send the instructor email stating that they had completed the feedback forms. The results of the forms were sent to the second researcher, and the results were not viewed by the first researcher until grades were submitted. Email assignment two required students to access the course pages, examine the links to APA reference sites, and comment on the usefulness of the sites to the course. Email assignment three was a progress report on their research proposal. Field notes recorded after conversations with the students were also examined to determine the impact of the web based materials.

Procedure

During the summer of 1998 an instructor web page was created with a link to a course web site. Some course materials for EDUC 541 were converted to HTML documents using Adobe PageMill and Microsoft FrontPage. The materials were divided into several broad categories which include: course objectives, course requirements, grading scale, course calendar, instructor information, and feedback forms. The first five categories contained information from the syllabus used in the class. Under course requirements were links to the university library and the ERIC database. The course calendar provided links to handouts used in class, course assignments, links to course related sites, and supplemental materials to facilitate the development of the research proposal.

Students enrolled in EDUC 541 during the Fall quarter were encouraged to participate in the project by accessing the course information on the web and completing four email assignments. Students were introduced to the site and told where to go on the site to access instructions for the required email assignments. Email assignment one required them to browse through the site, complete Feedback Form I, and send the instructor email indicating they had completed the form. During the quarter students were referred to the site to search for materials that would be useful as they completed their research proposals

and to download examples of the Human Use Committee forms that were to be included in the research proposal appendix. Often, this is the first course students encounter that requires them to use APA format for their papers. Hence, links to APA sites were added to the course web pages. For email assignment two students were asked to access two links to APA reference sites and comment on the perceived usefulness of the sites as they worked on their research proposals. Email assignment three asked for a progress report on their proposals. During the last week of class, Feedback Form II was placed on the web site for students to provide feedback on the web based course materials. Once students' grades were turned in, the results of the feedback forms and the email messages were collected and analyzed.

Data Analysis

Questions one through seven on Feedback Forms I and II required multiple choice and "yes/no" responses. On Feedback Form II questions 8 through 19 consisted of questions with "yes/no" answers followed by spaces for comments. Percentages were used to analyze the responses to the multiple choice and "yes/no" questions. Responses to the feedback forms, email messages, and personal conversations provided multiple sources of data. These multiple sources provided structural corroboration that enabled the researchers to examine recurring themes and draw conclusions (Eisner, 1998). Additionally, consensual validation (Eisner) was obtained by having the researchers independently examine and interpret the data.

The data obtained was coded and constant comparative data analysis was used to compare data codes within and across categories. Categories were compared and contrasted to determine similarities and distinctions among them as relationships were discovered (Leedy, 1997). The open ended responses, email messages, and personal conversations were examined to determine patterns in perceptions about the web based course materials across students' responses.

Results

Responses from the feedback forms, email messages, and personal conversations were analyzed to determine the impact of the web based course materials.

Results from Feedback Forms I and II

Fifteen responses were received to Feedback Form I and Feedback Form II. However, all sixteen students reported via email assignment one that they had completed Feedback Form I. Only one student did not report completing Form II. Questions one through five on both forms asked students technical information about their computers and Internet access. On Feedback Forms I and II 27% or four of the students indicated that they did not know the screen resolution or their monitor screen color. Two students indicated that they accessed the Internet via a modem at a public school, which corresponds with the two teachers who mentioned in class that they had Internet access at their schools. When completing Form I, 67% of the students indicated they accessed the web site from home and 74% indicated home access on Form II. Since most of the students in the class have full time jobs very few of the students were on campus on a regular basis, so accessing the web site was easier to do from home than from the university network. On Form I 47% indicated they had taken other classes requiring Internet access for course related materials and on Form II 40% indicated they had taken such courses. This indicates the possibility that two students completed only one of the forms.

Questions seven and eight on Feedback Form II asked about ease of use of the site and all of the students indicated that the site was easy to use and that they were able to access the information without assistance. The remaining questions on Feedback Form II asked students to elaborate on their responses to the questions posed. Question 9 asked if they had encountered any difficulties accessing the on-line materials, and question 10 asked them to briefly describe any difficulties. Student responses indicated that 27% encountered difficulties; however, none of the students elaborated on the difficulties. Some difficulties were mentioned in conversations, phone calls, and email messages. One student had difficulty configuring his home computer to enable him to use his university email account. He called one evening to chronicle his failed attempts to transmit the first email assignment. Technical assistance was provided over the phone

by the son of one of the researchers, and shortly thereafter his first email message was received. However, during the last two weeks of class the following was tacked on to email assignment three: "I am still having problems getting on line with E-mail." No mention was made of the specifics of the problems, and the student did complete all the email assignments. Some attempts to access Feedback Form II resulted in messages such as: "I completed email #4, but this appeared on the screen once I submitted the form:
HTTP/1.0 501 Not Supported
Does this mean that it was not received? Let me know if I should resend my answers."
Upon receipt of this and similar messages from other students, the problem was corrected and students were emailed that the form was working and to try submitting their answers again.

When asked in question 11 if they were able to find what they were looking for in a short period of time, 93% of the students indicated that they could. In response to question 12 students did have suggestions for making the site more user-friendly. These suggestions included:
"For the teacher to use the same terms in class that appear on the website. For example, if she says in class to click on the course requirements on the website, then there should be a place on the website that states course requirements."
"Once you have chosen a link . . . make it easy to get back to the home page."
"Study guides on the Internet."
Students' comments will be incorporated into the revisions of the web based course content for the Winter quarter.

When asked if the web site made the research class any easier, 73% indicated that it did. Only 10 students used either their own email account or a spouse's, indicating a lack of access to the web site which may account for those who did not find the web site useful. Or perhaps, the materials provided were not useful to these students. Students responses included:
"Course requirements and the APA section. Also it was good to know that I could always e-mail my Professor and get a timely response."
"The links to the reference sites."
"Information about the research proposal."
"It helped me in the literature review of my research proposal."

Responses to question 15 about the least useful part of the site included: course objectives, grading scale, and course schedule. Overwhelmingly, 80% of the students indicated in response to question 16 that they would take another course that required them to access the Internet. When asked to explain their responses, students wrote:
"I spend so much time on the computer anyway that I might as well get credit for doing something I love doing."
"Getting on the Internet lets me get answers on-line rather than having to call the Instructor."
"The Internet is very convenient for me because I can access it at any time (especially late at night)."
"The more I have to use the Internet, the easier it is to access the information needed."
"The Internet is the tool of tomorrow. If you do not learn to use it properly then you will be left behind."
Some students found the integration of the Internet into the class enjoyable, convenient, important to learn, and useful.

Students who would not take another course requiring Internet access offered these comments:
"I am not on-line yet and don't live near campus."
"I just don't feel comfortable using a computer. I would rather do it the old fashioned way."
The university is located in a rural area and local phone service ends just beyond the parish boundaries. Hence, students who do not live near campus have to pay long distance charges to access their free university email accounts from home. Some students would have to drive for an hour or more to use the computers in campus computer labs.

When asked in question 18, if they would take the course completely on-line, 27% indicated they would and 73% indicated they would not. Students who indicated they would take the course completely on-line offered these comments in question 19:
"yes only if i was on-line. i know access is offered through the college but i don't live near campus."
"The required usage of the internet has helped me to overcome my fear of the Internet."
One student indicated willingness to take the course on-line, but then commented:
"Education 541?????? No way. It was always good to have Dr. Matthew close by if I needed help."

Reasons for students not being willing to take the course on-line included the lack of human contact and interaction, needing face-to-face, one-on-one guidance, and the teacher.
"There is too much, i.e. citation problems and reference problems, that can usually be only handled face-to-face."
"Sometimes I need to talk to the instructor one on one."
"I think the class interaction is useful and helpful."
One student cognizant of a preferred learning style commented:
"I learn better by hearing the information."
Hence, further on-line development of the course will have to assure access to the professor in person and interaction with classmates for students who feel that this is needed for the successful completion of the course.

Results from Email Messages

Email messages were examined to 1) determine whether or not the students were using their own email accounts, 2) corroborate responses to open-ended questions, and 3) discover themes not addressed in the responses to the open-ended questions. Based on an examination of the email addresses used and student comments, it was determined that 9 of the 16 students had their own email addresses. One student used a spouse's address and the remaining 6 students used friends' or parents' email addresses. Three students used university email accounts. Another student tried repeatedly to get her university email account to work. After approximately two weeks of visits and phone calls to the computing center, she opted to use her boyfriend's account with a local Internet service provider.

Email assignment two required the students to access two APA links and comment on their usefulness for writing their research proposals. Reviews of the APA sites were mixed and included the following:
"I have completed the second email assignment. The APA FAQ page was particularly useful and easier than finding what I needed in the book."
"I just figured the APA site out. It seems like it would be pretty helpful. I especially like the section under APA on references. I have a hard time with references and I hate having to go back and flip through the book trying to figure out which to use. This way, I can just go here and the different types are clear. I going back now to search on that APA journals section. I just wanted to let you know that I found it."

Email assignment three was a progress report on their research proposals which elicited a range of responses:
"My research proposal is coming along fine. still have a few bugs to work out and need to finish the introduction."
"The proposal seems to be going very slow. I think I've found all of the articles I need, but I'm having trouble putting it all together. The limitations section has me 'tangled up in blues' as does the basic assumptions."

Students encountered a variety of problems when using the Internet. Whereas some of the students were quite resourceful and persistent about finding Internet access and completing their email assignments by the deadline, one student elected to just wait until her classroom Internet access was available. Three days after the quarter ended, I received the last three email assignments from her. Email assignment two read:
"I did browse the APA web site suggested. I wish that the internet would have been working for me to have used that site in my research proposal. I think that it would have made the paper a bit easier.
Lincoln Parish Schools Internet services were repaired today."

Only two students went beyond the required email assignments and used email as a means of communicating about their research proposals. One student submitted a rough draft of his proposal abstract. Then, he inadvertently wiped out the inbox in his email account and was not sure if I had responded or not. This was his only attempt to submit a draft via email, and he backed it up with a print copy as noted in his email message:
"Dr. Matthew - I didn't get a chance to check if you had sent me an e-mail before it was all erased. If you had please send it again....if not I'll check again later.
Thank you – (Student's Name)
p.s. I'm assuming you got the copy I left attached to your office door."

Another student wrote requesting assistance on locating references for his proposal:
"I am beginning to really become concerned about the state of my review of literature. The articles that I ordered through inter-library loan are not coming through. I've tried the Carl Un cover system but the articles that I need are in journals that say this journal does not allow faxing of its articles." Any suggestions? I am going to go to LSUS and look for any thing today. If you've got any other ideas would you e-mail me back. I'll check my mail intermitteningly through out the day, so any suggestions you might can offer would be greatly appreciated. Thank you again for all your help."
This message was received three weeks before the proposal was due and fortunately, later that week his inter-library loan articles arrived.

Within 24 to 48 hours of sending messages, students received a reply stating that their message had been received. When additional comments were written or questions asked, the students frequently did not respond. One reason for this could be the fact that many of the students were using borrowed email addresses.

Conversations with students before and after class indicated that the Internet requirement for the course had impacted them beyond the course requirements. One student commented that the required email assignments forced her to get an email account. Once she acquired the account, she began using it to email several friends who live out of state.

Conclusions

As anticipated the students had a variety of technical skill levels and prior experiences with the Internet. Students' responses indicated that the site was easy to navigate; however, they did have suggestions for improvement. As site development continues, their suggestions will be implemented. Students indicated that they enjoyed the convenience of being able to access the web as needed and being able to contact the instructor by email. They encountered the same barriers as mentioned in other research studies such as, configuring software, down servers, and lack of access to computers.

Requiring students to use the Internet is not a common practice in the College of Education, hence, there was some concern about the implementation of the Internet in this course. Only minimal use of the Internet was required during the Fall quarter. The Winter quarter will require the students to access more materials from the Internet and will include group activities to be completed outside of class time using Internet resources and email. Students positive responses to the use of the Internet are encouraging. However, their concern for a lack of human contact and interaction in an on-line course will need to be addressed as the materials and activities for the course are developed.

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If we built a discussion list, would they come?

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Abstract: With the Internet gaining its popularity among teachers, an effort was made to engage teachers in actively communicating via discussion list with each other between two groups of teachers from New Jersey and Wisconsin. Although most teachers considered the discussion device useful, they did not actively participate in the discussion activities. Several factors were identified to slow down the communication among teachers. This paper describes the discussion activities among participating teachers and attempts to analyze various factors that may contribute to the successful communication in the discussion activities. Finally this paper makes suggestions about how to enhance such an experience in the future.

A discussion list for teachers from two states

The Internet is rapidly growing into the education world each day. However, the Internet does not seem to have changed the teachers' nature of being isolated. With ubiquitous Internet access from home or school, more teachers than ever have experiences of using the World Wide Web (WWW). These teachers learn to use local computers to access the Information Highway and locate valuable resources they desired. However, many Internet-using teachers that we know are passive information receivers. They neither contribute to the development of the new Internet resources by creating new information or applications, nor do they share resources and experiences with other teachers. The isolation among these teachers still exists.

Long-distance correspondence via e-mail is a popular use of telecommunications in schools. The correspondence can be used for several different purposes in the learning of many subjects or in connecting a group of people for consultations or idea sharing. To promote the use of the Internet to connect teachers with each other and to minimize the isolation among teachers, an effort was made to encourage teachers to use the Internet not only to find information but also to share resources and experiences via the listserv discussion. The listserv is an e-mail mailing list that distributes mail to all participants on the list and to which any participant can publish mail. During the summer of 1998, 31 teachers from New Jersey and Wisconsin joined a private listserv discussion. Through two separate computer courses offered from The College of New Jersey (TCNJ) and the University of Wisconsin at Whitewater (UWW), participating teachers were introduced the listserv discussion service and were also strongly encouraged to participate in the joint discussion activities between the two groups. The goals of the joint class discussion list were as follows:

- Familiarize teachers with the discussion list technology as a means to communicate with other teachers.
- Identify factors that obstruct teachers from effective participation in the discussion.
- Explore strategies to engage teachers in actively participating in discussion list activities.
- Model the use of discussion list to support teaching, learning, and communication among teachers.

This paper also intends to explore the following issues.

- If teachers are taught how to use the listserv, will they adopt it and find it useful?
- Will teachers be able to learn from each other via the listserv?
- What kinds of behavior and performance are visible as teachers communicate with each other?
- What kinds of difficulties exist in using the listserv for teacher communication?
- How can we motivate teachers to use the listserv as a tools for classroom instruction enrichment?

The discussion list activities

The following information about the discussion list activities includes an initial survey of students' background information, a series of observations of participants' performances, interviews of participants, and analysis of the participants' messages over one full-week period during the summer session.

The profiles of the participants

Thirty-one inservice and pre-service teachers participated in the listserv discussion activities. All 21 participating teachers in the UWW were inservice teachers while five out of nine NJ students were preservice teachers with limited school experiences. The WI participants were more computer-experienced than the NJ participants, in that most of WI participants had taken one or two computer courses prior to this course and most WI participants had some prior listserv discussion experience. In contrast, most NJ participants were the first-time listserv users and this computer course was their first computer course in the program. Most of NJ participants did not have e-mail access from home so that they could only send and read messages while attending the class. Although many WI participants had e-mail access, most of the e-mail messages were sent during the class.

Participant's perception about the list

From the initial survey, all teachers considered the discussion list a positive device to communicate with other teachers. They appreciated the learning of such a device and hoped to get much out of such an experience. After learning how the discussion list operated, they were encouraged to use it as a means to communicating with each other and to acquiring new information. Most participating teachers confirmed that this was a wonderful opportunity for them to learn about how teachers from another state used technology for their work. Until the end of the semester, most participating teachers still considered the discussion list a useful tool to communicate with one another.

Also there were some second opinions regarding the list. While most NJ students were excited to have an opportunity to join the discussion with others, a few of them did not feel comfortable about communicating with people they could not see in person. Some NJ participants commented that they did not know what to say and what to ask. Other participants considered the summer session an inappropriate time for teachers to engage in such an activity because people were busy with their course work and they did not have urgent issues to discuss at this point.

Many participants shared their perceptions about the discussion list in the post interview. They believed that listserv could be a useful device to engage conversation and to acquire information, even in their own class. They also realized that it might take a while before their students would be able to use such a device because their schools were not fully equipped with fast access to the Internet yet. The biggest advantage for the discussion list, as many of them pointed, was the ubiquitous access of e-mail which allows us to use it any time and anywhere so that people do not necessarily have to be on-line at the same time and still can get the discussion moving on. They also learned that once a message was sent to the list, everyone would get it. This feature alerted them to modify and maintain desired behavior during the communication, they became more careful about their writing. They also agreed that Nettiquette issues and proper language issues should be addressed seriously in their own class.

Instructor involvement and student participation requirements.

The instructors of the courses acted as facilitator of the learning and services as well as participants. The instructors from both campuses provided basic listserv instruction, set up the discussion list, coordinated the discussion activities, and encouraged the participants to put in their best effort to learn from each other via e-mail exchange. NJ students were taught the procedures of subscribing to the listserv and were required to send at least two message to the list. The WI participants were encouraged but not required to send or respond any messages to the discussion list. The participation of WI students in the discussion list is on a voluntary basis.

The messages from the discussion list

Throughout the entire discussion activities, a number of questions were raised regarding various topics, including, "security of purchasing on the net", "suggestions to do electronic portfolio", "criteria of selecting good web sites", "how parents and teachers can prevent kids from getting lured into certain web sites", "copyright issues on the net", "sites of on-line tutorial on web page development", and many others. There were 55 messages altogether, with 27 from WI and 28 from NJ as shown in Table 1. The messages can fall into four categories: inquiry and issues, response to inquiry and issues, self-introduction, and information sharing. The nature of the messages was mostly inquiry, issues, and responses. WI participants seemed to have made more responses to the messages than NJ participants. However WI participants responded more messages only to their home group, discussing issues such as their class schedule and assignment.

Table 1. Messages from the discussion list

	WI	NJ	Total # of messages
New inquiry/ issues	13	12	25
Response	10	3	13
Self-introduction	2	8	10
Share info	2	5	7
To both groups	14	25	39
To home group	13	3	16
Total # of messages	27	28	55

Difficulties encountered

Two kinds of difficulties occurred in the discussion list activities: technical difficulty and adequate access to the Internet.

1. Mechanical difficulty. All the students were able to log in and subscribe to the discussion list through the listserv and send messages to the list. However, many new Internet users got confused about the listserv and discussion list. For example, they were puzzled by the fact that once they had subscribed to the listserv, they should send discussion messages to the discussion list and they should get off the discussion list by sending a request to the listserv. It took some explaining and hands-on activities to make them fully understand the operation and feel comfortable about the process.

2. Time and access to the Internet. Most of the NJ participants did not have access to the Internet at home. They would have to rely on the access in the computer lab and during the class time. Two NJ students were overwhelmed by the number of messages they received and felt uncomfortable in sending more message because they thought it was too time-consuming for them to handle the discussion list.

Inadequate communication

Throughout the entire discussion activities, many shortcomings other than the technical difficulties were observed. The communication seemed less interactive than intended. During the discussion list activities, most students focused on the things they were most interested and neglected other people's messages. Most participating teachers tended to ask questions or shared information about what they know and what they have found on the Internet rather than responding to other people's inquiry or issues. This is probably because they did not have a good knowledge and skills to answer the questions being asked, or they were reluctant to respond to people they did not know well. The language used in the e-mail messages seemed rather informal and contained many spelling and grammatical errors. The information or advice offered by individuals usually seem too shallow to answer other people needs. Also, many people tended to communicate only with people from their home group and were indifferent to the other group. Still a couple of people sent personal message to the discussion list by mistake.

Respond now or never

Most participants tended to read messages and respond immediately. Because they use either the VAX or UNIX e-mail system, it takes time for them to go back to check older messages. If they didn't respond

immediately, they were not likely to go back to read and respond to the messages later, especially during the tight summer schedule

Getting started with a simple self-introduction

Since this discussion was established for two class groups where members did not know each other. Many people started by sending a self-introduction message followed by questions or comments. This had proved to be a useful strategy.

Students' comments about the listserv activities

The following are some comments that students made regarding the discussion list activities.

> "It's a great feeling to see someone that you don't know responding to your message."

> "It can be a frustrating experience when nobody answered your inquiry for a long while. However, if you don't hear from others, that suggests that the topic you raised did not catch their eyes or maybe they just didn't have an answer."

> "Some possible reasons why we received too few responses could be, 1)The listserv might be too new to some of us; 2) The number of participants is too small; and 3) most participants are not very knowledgeable about other people's area."

> "I wish I knew enough to respond other people's questions or comments. I simply don't know what to say to others."

> "Listserv is a good device for teachers to communicate."

> "I believe this is a good opportunity to find out more about what other teachers do with computers. I also think the listserv discussion may help reduce teacher isolation."

> "Posting questions or message without getting responses reduces the value of a listserv and is also frustrating."

> "If we can get our schools connected to the Internet, our students can exchange e-mail with each other like what we are doing here."

Discussion

If teachers are taught how to use the listserv, will they adopt it and find it useful?

In spite of the frustration in the slow e-mail communication, most of the participants did consider the discussion list a feasible and useful tool. Through the entire discussion list activities, participating teachers had exchanged ideas by posting questions and responding to each others' message. Teachers who had learned to use the listserv discussion are likely to continue to use it and learn from other people. From the initial survey and post interview with participants, most teachers considered this a beneficial device for themselves as well as for their own classes.

Why didn't they take advantage of the listserv?

The participating teachers did not seem to have optimized the list discussion opportunity to communicate with each other. As analyzed from the observations and interviews with the participants, the possible reasons are 1) participants did not have enough access time to participate more often, 2) it's a bad timing during the summer with intensive course work and no time to ask questions, 3) participants did not posses enough knowledge or skills to make appropriate comments or responses, 4) they had been shy about communicating with strangers, 5) there was not enough incentive for some participants to play an active role because the WI instructor did not mandate required participation for all participants, 6) most of these teachers

were not working during summer and did not have immediate needs to solve any particular problems or to discuss about certain issues, and 7) the courses were ill-structured for such kind of activities. If the courses were designed with the same goals and similar themes and connected the discussion list to the content learning, the results could be significantly different.

How can we engage teachers to use the listserv as a tools for self or instruction enrichment?

From the experiences learned in this study, several strategies may be used to increase the participation in discussion list activities.

- Set minimal requirements about participation. Based on the nature of the discussion activities, participants should be encouraged to use the listserv and send messages at an early stage. Once they become familiar with the discussion list, it will take time for them to find the value of using it.
- Assign duties to participants so that they will become active discussion leaders, instead of being passive information receivers. After they start taking leadership in the discussion, they may become appreciative about getting messages from other people.
- Identify relevant contents for discussion. In most cases, the discussion activities turn boring or fruitless because participants do not have input about what they want to talk about. When discussion issues are clearly defined, participants may prepare questions or information for the discussion. In this way, they will be able to focus on the same discussion issues and conduct some research work for their discussion assignment. The results will become more meaningful.
- Relate discussion topics to participants' own experiences or interests. Sharing participants' personal experiences may help maintain and further extend discussions.
- Encourage the use of self-introduction detailing one's specialty areas, prior experiences, and interests to help break the ice for discussion.
- Remind users to use formal languages and watch Nettiquette issues.

Conclusion:

The discussion list has provided a unique channel of communication in education. Teachers, having long been considered isolated, may use such a channel to communicate with each other. This paper describes an effort to connect teachers from NJ and WI via the discussion list from two separate computer courses. These teachers were taught how to use the discussion list and were encouraged to participate in the discussion. Although many teachers did not take advantage of the listserv or made contributions to the discussion activities, most of them believed that the discussion list was a useful tool for themselves and for their own class. This paper also identifies some factors that affected the teachers' participation, including, timing, access, personality, knowledge and skills, and structure of the courses. Based on the analysis of these factors, some suggestions were provided for future practice.

Telecommunications As an Object And a Tool for Teaching and Learning

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Abstract: This paper provides an overview of a collaborative project in progress involving mixed traditional and on-line teaching, flexible independent learning and psychology assistance for Russian students. The project is educational, methodological and researchable in nature and involves the distance course "Technical Writing" delivered by Metropolitan State College of Denver to students of Rostov State Pedagogical University in Russia. Features of this project are discussed, followed by issues facing Russian educators.

Telecommunications is a very attractive area for innovators from all levels of education. The main trends for an application of educational telecomputing are widespread communication for professional and learning purposes and rapid access to important subject information. Communication is a necessary element for effective instruction and methodology training of preservice teachers in higher school. Active pedagogical, educational contacts are the main means of providing assistance in accomplishing the instruction tasks in traditional school. Simply put, computer telecommunications allows ample opportunities for these contacts to professionals, educational associations, and social-psychological group collaboration using numerous services of global networks as e-mail, mailing list, WWW, news conference, videoconference etc. Use of e-mail and the web to deliver coursework is the object of study. The structure of teaching doesn't change in this case, but communication is somewhat limited between student and teacher. Nevertheless telecommunication applications used in this manner are preferable in Russia because of slow connection and expensive commercial account for more educational institutions.

Use of videoconferencing and other advanced methods can result in more innovational approaches. On-line or distance learning is used now for different subjects. But in Russia, preference is given to interdisciplinary collaboration of Informatics or Information Technologies and subjects such as English Language, Management, Technical Translation etc. Distance education is desirable because of the lack of prepared specialists and students at many universities.. The computer and telecomputing skills of many students at Russian Colleges and Universities are not satisfactory now but grow year by year thanks to home computers and commercial courses offered in Russia.

The most potential for on-line teaching and learning uses Web technology. It can be used as sources for educational and science information, search engines, bases of data etc. Depending on the educational tasks, suitable URLs or search engines can be used for finding sources of information. Both online and traditional teaching are right for passive and active students. But the success or failure of these methods depends on the educational tasks and outcomes desired . The ways the primary information is delivered and received is not as important as the educational product and content delivered made by them and possibility of the resultant increase in communication. Thus on-line teaching is often desirable, but not always possible to carry out today, and this is the focus of our project.

Rostov State Pedagogical University (Russia) and Metropolitan State College of Denver, Colorado (USA) began the joint project based on the distance course "Introduction to Technical Writing" delivered from Metropolitan State College during Fall 1998. For Russian students, the project means mixed learning by traditional (lectures and practice in computer and telecommunication classrooms), independence (home and work at classes) and innovative forms (on-line and collaborative learning). In this way telecommunications and networks are presented as the means for traditional and as the tool for online teaching and learning (the part of independent and innovative forms). For Russian and American tutors and instructors it means use of more flexible methods of teaching For getting a success and a benefit from this and other foreign courses, it's necessary to have a good command of language (in our case it is English language) and computing skills. All Russian students participating in the project study at the Foreign Language Department and were tested on an

English language level before participating in the on-line course. Their computer skills were tested as well and advanced by individual lessons with instructors and independently in computer classes if it were necessity. The third limitation is that of telecomputing skills, which is not an obstacle in this case because of the inclusion of the introductory lectures, practices and independence learning in traditional computer classes and because of full access to Internet. Introductory lectures included the review of global networks and Internet, popular telecommunication services as e-mail and WWW, digital equipment as camcorders, etc. Practice lessons include work with e-mail programs and browsers. The fourth limitation is mental or psychological obstacles for getting study by distance for Russian students. We made some psychological tests for Russian students before the distance study and will make ones at the end of our project. In the opinion of the Russian author, psychology assistance is the necessity component for foreign on-line study because of lack of traditional visual and audio contacts and language and social obstacles.

The project is both educational/methodological and researchable in nature. For Russian educators the goal of this research project is to produce knowledge and skills in the area of on-line teaching for Foreign Languages Faculty of the University for future active innovation in instruction.

The distance course used in this project uses personal computers instead of the traditional classroom/lecture setting to conduct the course material for both American and Russian students. Purposes of this course are:

- to acquaint students with the names and content of various types of technical reports used in business, industry and government;
- to acquaint students with some basic formats used in business, industry, and government;
- to make students aware of some basic differences between material written in a technical style and that used in other types of writing;
- to give experience in preparing technical reports for a variety of audiences;
- to give experience in preparing written and oral technical presentations for a person in a decision-making capacity.

Content and requirements for this course are the same as for the traditional classroom version of Metropolitan State College of Denver's COM 2610 which uses the textbook authored by Markel [1996].

The Web page with course materials can be found at http://clem.mscd.edu/~2160 and consist of follow sections:

- Course syllabus
- Course schedule
- Assignments
- Using Search Engines for Research
- Resources for technical Writers
- Ideas and Topics for Papers and Projects
- Meet the other students in the Class

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Forms of Synchronous Dialogue Resulting from Web-based Professional Development

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Abstract: This paper provides a consideration of ways in which synchronous dialogue can contribute to a program of Web-based professional development. Online chat transcripts were analyzed using a framework for classifying forms of dialogue in a telecommunications environment. Synchronous dialogue behaviors emerging from the analysis were classified into four over-arching categories: Instruction, Inquiry, Conversation and Debate. Portions of transcripts provide a notion of the context in which these behaviors arise. Synchronous dialogue is contrasted with asynchronous communications typically found in online learning environments. Unique aspects of synchronous dialogue center on the dynamic nature of the interaction, which can result in simultaneous strands of dialogue as well as the presence of debate in interchanges.

Background

Distance learning networks are changing the face of education and training in ways that could not have been imagined even ten years ago, thanks largely to the ubiquity of the World Wide Web. Universities in particular are discovering that "Distance learning networks can be used for all forms of education to improve the reach of programs, stretch education and training dollars, and deliver just-in-time educational content to learners anywhere, anytime" [Chute, Sayers & Gardner 1997, p. 76]. The Department of Mathematics and Statistics at the University of North Carolina at Wilmington has developed a World Wide Web site called INSTRUCT, which stands for *I*mplementing the *N*CTM *S*chool *T*eaching *R*ecommendations *U*sing *C*ollaborative *T*elecommunications (http://instruct.cms.uncwil.edu). INSTRUCT is designed to support inservice school mathematics instructors as they implement the National Council of Teachers of Mathematics *Professional standards for teaching mathematics* [NCTM 1991] in their classrooms.

The literature on distance learning networks and teacher professional development agree that interaction represents a powerful method for engaging learners [Chute, Sayers & Gardner 1997; Scardamalia & Bereiter 1993; Guskey 1986], yet too often this aspect of distance education and training is either forgotten or given only passing consideration. INSTRUCT's design intentionally integrates aspects of groupware, or software intended to support group interaction, to expand its use beyond being simply a storehouse of instructional material. INSTRUCT provides the option for users to communicate synchronously or asynchronously, as appropriate, as a primary resource for establishing and maintaining group integrity [Mandviwalla & Olfman 1994].

[Cohen, McLaughlin, & Talbert 1993] asserts that "The only way we change our teaching is to talk to people who are also changing" (p. 93). INSTRUCT participants are given assignments to carry out in their own mathematics classes in order to promote teacher active participation in and application of online training materials. An intentional by-product of these assignments is the need for sustained interaction and collaboration among participants. The standards material includes notions of what constitutes worthwhile mathematical tasks, ways of establishing a classroom learning environment that promotes student discourse, and methods for self-analysis of teaching and learning events that can enhance classroom instruction. For each of six standards, teachers have the opportunity to be engaged in two synchronous meetings, one to discuss the hypermedia material and brainstorm ideas before implementation, one to reflect on implementation attempts and future applications.

Theoretical Framework

[Blanton, Moorman, & Trathen 1998] proposes a classification scheme for the forms of dialogue that can occur in a telecommunications environment. The authors' classification research focused on analyzing asynchronous dialogue contained in e-mail discussions. The classification scheme is shown below (Tab. 1).

	Convergent	Divergent
Critical	*Instruction*	*Debate*
Inclusive	*Inquiry*	*Conversation*

Table 1: Classification Scheme for Telecommunications Dialogue

For the purposes of this classification scheme, the authors define Convergent situations as those in which participants assume one correct answer, as opposed to the Divergent condition in which multiple interpretations are possible. Critical situations are defined as those involving some kind of analysis, questioning or perhaps skepticism, and this is contrasted with an Inclusive environment in which each participant's contribution is valued and accepted. The classifications therefore represent intersections of pairs of these situations: *Instruction* (Convergent-Critical), *Debate* (Divergent-Critical), *Inquiry* (Convergent-Inclusive), and *Conversation* (Divergent-Inclusive). As a result of their research on asynchronous dialogue, the authors found evidence for three of four of the classifications: *Conversation* (the pre-dominant mode), *Inquiry* and *Instruction*. The authors found no indication of *Debate* playing an important role in the asynchronous communications that were analyzed for their studies.

The Study

The purpose of the present analysis is to attempt a classification of the types of synchronous dialogue INSTRUCT participants engaged in during their online meetings. Chat transcripts were analyzed from online meetings held during Fall semester 1997 among 13 participants and three facilitators. Participants were primarily high school and middle school mathematics teachers. Analysis focused on the portions of the chat transcripts that dealt specifically with some aspect of the Professional Standards training materials. The following categories of synchronous dialogue have emerged from initial analyses (an example of each is provided in parentheses):

Affirmation of another participant's efforts ("I like that ….")
Belief about teaching/learning ("I think that a group needs half and half strong [students].")
Concern about implementation ("The really smart kid may talk too much like a teacher…and turn the weaker kid off.")
Current practice ("I use groups on the average of once a week…it is not my main thing.")
Desire to implement ("I also want to do some on line researching for some things that I don't have time to search for now.")
Intent to implement ("I had planned to use the scoring sheet and their scores as part of the analysis.")
Question about implementation ("Does everyone else sit [students] in rows and then move to groups or are your desks in groups?")
Result of implementation ("My other 2 groups with the exception of a very few that are full of raging hormones really work well in groups.")

The Blanton, et al. classification scheme detailed earlier is intended to encapsulate telecommunications dialogue generally; therefore, it seemed reasonable that the classifications might be used to capture forms of

synchronous dialogue as well as asynchronous. Based on analyses done for the present study, the categories of dialogic behaviors identified from the chat transcripts would seem to lend themselves to being grouped according to the proposed framework as indicated below (Tab. 2).

	Convergent	Divergent
Critical	*Instruction* Belief Concern	*Debate* Belief Concern
Inclusive	*Inquiry* Affirmation Desire Intent Question	*Conversation* Affirmation Current Practice Question Result

Table 2: Categories of Synchronous Dialogic Behavior

Results from analyses confirm the adequacy of the Blanton, et al. classification scheme for use with synchronous dialogue. Notice that the categories of Belief and Concern actually span both *Instruction* and *Debate*, depending on whether participants simply reported their personal beliefs/concerns or if they actually argued for or against expressed beliefs/concerns. The presence of *Debate* appears to depend to some extent on the personalities of those involved in the dialogue. A sample exchange follows in which Teacher 2, who possessed both a strong personality and a highly practical view of teaching, took on the role of spoiler in a discussion of a classroom activity implemented by Teacher 1.

<Teacher 1> One of the games my students really enjoy is basketball. I actually shoot baskets into the trash can using paper balls. We divide the class into two teams and play until everyone has had three shots. Then I use data from shots to teach ratio and proportion.
<Teacher 2> That's a great idea. I just hope the principal doesn't come to observe my class during the basketball lesson.
<Teacher 3> ...I echo that.
<Facilitator> ...I dare say he would be impressed.
<Teacher 1> I have that fear too.... It would take a lot of explaining!
<Teacher 3> ...mine calls that "Stepping out of the box."
<Teacher 2> Unfortunately mine would call it 24 students off task for twenty minutes.

Therefore, unlike the results of Blanton, et al. for asynchronous dialogue, it was possible to classify aspects of synchronous dialogue under *Debate*. Examples of *Instruction* and *Conversation* are provided later in this section as simultaneous strands of dialogue during a single chat. *Inquiry* and *Conversation* include some overlapping behaviors (Affirmation, Question). However, *Inquiry* differs from *Conversation* in the convergent nature of the comments, which generally have to do with the Desire or Intent to implement a particular method or activity. An example of *Inquiry* follows:

<Teacher > …I plan to use this [geometry scavenger hunt activity] for my last standard, is that acceptable?
<Facilitator> Depends what kind of analysis was used, I guess….Could they possibly do a reflection writing piece on their experience…?
<Teacher > That's an idea. I had planned to use the scoring sheet and their scores as part of the analysis.
<Facilitator> What I found, why it's important, etc.…I think it would be great for writing.
<Teacher > I'll follow through with your idea…and send you some of the papers I get.

Unlike asynchronous dialogue, which tends to follow specified threads based on the subject of a particular posting, simultaneous synchronous dialogues may emerge due to the dynamic nature of the environment. An example follows of two qualitatively different dialogues which took place simultaneously during a single chat session. Strand 1 can be characterized as *Instruction* dominated by convergent expressions of Belief

and Concern, whereas Strand 2 is a *Conversation* primarily containing divergent Current practices and Results of implementation. The comments from the strands have been staggered to indicate the order in which they came up in the overall dialogue, and words or endings of words have been included in brackets to clarify comments.

Strand 1	Strand 2
<Teacher A> Dare I ask if anybody had a chance to look at the section regarding "stories?" I found this very interesting, especially in light of all the chat regarding writing and journals. What a wonderful way to take care of a multidiscipline requirement. <Facilitator> Expand on that....	
	<Teacher B> ...I gave a test on solving equations today and plan to start solving inequalities tomorrow. I just have a fear of not covering everything. <Teacher C> We in block all have that fear!!! <Teacher D> ...since I'm using the Algebra I Resource Book, I'm teaching differently this year. I'm not going straight through the book. It's hard to compare to last year. <Facilitator> ...I still firmly believe it is more important they learn a lot well instead of "all" just so-so.
<Teacher A> ...just before entering the chat shop, I looked over the Standards, for Tools to Enhance Discourse. Well, under Using Stories as a Tool, a [teacher] has a lesson plan for using writing stories that lead to a conclusion which is a given math equation [or] solution. I think I could modify this for my 5th graders.	
	<Teacher C> A lot well is great if it [is] the right areas that are tested [on the state End-Of-Course, or EOC tests]. <Facilitator> I know our Alg 1 teachers are trying to teach to the objectives instead of going straight through the book. <Teacher B> I'm not really going straight through the book either, so sometimes I wonder if I've missed something! <Facilitator> They are also trying to incorporate applications since the EOC is based that way now.
<Teacher E> ...one time I read my eighth graders the book "The Dot and the Line" a geometry love story. Then they chose math symbols and wrote and illustrated their own love stories. They loved it and I felt they really learn[ed] from the activity.	
	<Teacher B> ...I agree with you completely. Oh for the good ole days when we could just teach without having to worry about 1001 objectives!

<Facilitator> ...do you still have any of the samples of what the students wrote?

<Teacher E> I think I do. I will look for them.
<Teacher C> I don't know how English teachers stand it. When I read my students writing it makes me ill.
<Facilitator> ...I am with you. I can't imagine grading a term paper or even an essay by my students.
<Teacher E> I think stories would be difficult to use at the high school level but I used them all the time in middle school.

<Teacher C> I am in block and will only cover what is on the EOC test, concentrating on the higher percentage areas. It think it is wrong, at least for my Algebra B students, but the EOC seems to be all that matters.
<Teacher B> That [is] my concern too....

<Teacher D> I agree...!

It is interesting that except for Teacher C's comment at the end of the first strand, these two substantive dialogues were carried out simultaneously by two separate groups of participants involved in the same chat. Further, it is important to observe the role of the Facilitator (a teacher who had previously been through INSTRUCT training) who acknowledged comments and encouraged contributions during both strands. As noted in [Shotsberger 1997], "...given the text-based environment of many conferencing or discussion tools and the resulting lack of cues that tend to regulate social interaction, the task of mediating group activity while promoting some kind of kinship among learners is challenging in the extreme" (p. 104). Yet, this kind of interaction, if properly cultivated, can come to be viewed by teachers as a natural environment for the exchange of ideas and experiences.

Implications

Unique aspects of synchronous communications identified in the INSTRUCT transcripts appear to result from the dynamic nature of the environment, which can produce simultaneous strands of dialogue as well as the presence of debate in interchanges. As online facilitators better understand the dynamics of synchronous communication, this rich form of interaction has the potential to make Web-based training an important component of teacher professional development. Unfortunately, due to time/place constraints, real-time chats do not currently play a significant role in most online education and training efforts. To address this limitation, INSTRUCT offers two meeting times per week, one in the afternoon and one in the evening, to encourage teachers to participate from school or home. This flexibility has turned out to be a key element of teacher satisfaction with INSTRUCT.

INSTRUCT participants are encouraged to use both synchronous and asynchronous means of communication, yet it was synchronous dialogue that was crucial in providing teachers a "...rich, safe and self-sustaining environment for implementing changes in instructional practice" [Shotsberger in press]. Participants from Fall 1997 each submitted responses to an online survey at the end of the semester-long program. When asked what they enjoyed most about using INSTRUCT, the majority of respondents included some comment about the unique impact the chats had on their experience. Sample comments from three participants follow: "I enjoyed chatting and sharing ideas with other teachers the most. I don't feel so alone when I know others are experiencing the same things I am;" "I truly enjoyed the on line chats weekly. I think the ability to discuss weekly with other teachers that are working on the ideas that you are trying in your classroom was the most valuable;" and "I thoroughly enjoyed the opportunity to gather at a

regular interval with my fellow teaching professionals. We shared our experiences and served as a peer resource for others for the overall improvement of not only our friends and fellow teachers but also improved the teaching of math concepts in so many schools and minds." The quality of professional interchange and collegiality reflected in these comments and in the sample chat transcripts is impressive, even in comparison with face-to-face professional development. Moreover, bear in mind that these participants were communicating using a text-based chat program, with all of the incumbent challenges of getting and staying online, perhaps being a marginal typist, and attempting to express oneself in a largely expressionless environment. The growing affordability of computer technology, coupled with more reliable network connections and improvements in synchronous communications such as desktop video conferencing, make Web-based training a viable alternative for current and future teacher professional development programs. Developers and facilitators of Web-based education and training are obliged to think seriously about the critical role interaction plays in learning and how synchronous communications tools might best be employed to foster that interaction.

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Database, Collaborative Learning, and Internet

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Abstract: Web-based instruction has become a powerful tool in recent years. However, WBI utilizing a Constructivism theoretical framework has not been explored. A database-driven WBI is the solution for this implementation. Another critical issue is the difficulty encountered in creating, editing and maintaining WBIs particularly for those lacking experience in HTML creation. EMC 598 Internet for Teachers, a hybrid televised and Internet course, is designed with the integration of database-driven instruction. The database manages student publishing, an online grade book, a final project...etc. This program does not require the instructors or the students to be familiar with web page creation.

Introduction

The integration of web-based instruction (WBI) into classrooms has been one of the most important instructional designs to be developed in recent years. Web page design has become the most popular strategy for the delivery of information and communication among educators and students. Creating web pages is not a critical issue for most instructional designs. However, updating and maintenance are the most critical tasks encountered in WBI design. It is very common to see web pages that haven't been updated or maintained. The primary reasons for avoiding updates are that editing HTML codes is time-consuming, and teachers and students are not familiar, or are uncomfortable, with HTML editing. With a database-driven strategy, these two issues can be resolved.

Theoretical Framework

Improving instructional design is not the primary reason to use a database. Conceptually, Constructivism is the theoretic basis of distance education (Jonassen, 1995). Remote access to online databases may facilitate the construction of knowledge. Retrieved information can be used to support positions in a computer conference discussion, for elaboration on a particular topic, or for satisfying personal curiosity. Knowledge construction is fostered through the intentional searching process and by linking information to the learner's own schema. Merely locating information in a database does not necessarily lead to learning. Critical to the knowledge construction process is the articulation of the learner's behavior while performing a database search. This search facilitates and strengthens connections between elements of information and results in higher-order thinking and meaningful learning. A database learning environment requires learners to reflect upon personal knowledge, state learning intentions, and publish ideas to a communal database, thus producing cumulative, progressive results for the group.

A Database-driven Graduate Course

EMC 598 Internet for Teachers is a graduate level course offered through a distance education format utilizing a combination of television and Internet technologies. It utilizes FileMaker Pro, a web-compatible database by Claris Work, to enhance the instructional design. This database-driven design includes student publishing, course management, and final project management.

Assignment Database

The online assignment database is an important aspect of database design. Student publishing has been a very powerful strategy for instructional design. Teachers and students confront the issues of web page creation and maintenance by student publishing on the web. Frequently, teachers and students spend a tremendous amount of time and energy on web page creation, resulting in an inability to focus on the instruction and content. The purpose of student publishing is not learning how to create web pages. When teachers and students are able to achieve the creation of web pages, the student publishing normally is not well organized and is not searchable. It simply provides static information and limited interaction. Web page creation is only the first critical issue in student publishing; the second issue is the FTP (File Transfer Protocol) barrier. Unless teachers and students understand FTP, another learning necessity is created which is not the intention of student publishing.

An online assignment database can be the solution for web student publishing. In this reaction paper assignment database, students compose their assignment on a word processor, then copy-paste the response to the web browser, and submit it, or simply compose the assignment on the browser directly (Fig.1). Students paste their assignment to the proper web fields, such as the title field, the body text field, keyword fields for the title and the target audience, and submit it. When students submit their assignment on the browser, the assignment is converted into an HTML format and a searchable database because the keyword fields are created at the same time. Students and teachers can search the database on the web by keyword, title, author, or subject, etc (Fig.1). This assignment posting doesn't require students and teachers to be familiar with HTML creation and editing. After students have posted their assignments, an editing page allows them to update or edit the assignments they have posted. This design provides students with more interactions through the database, and reduces the maintenance, editing, and updating duties for teachers.

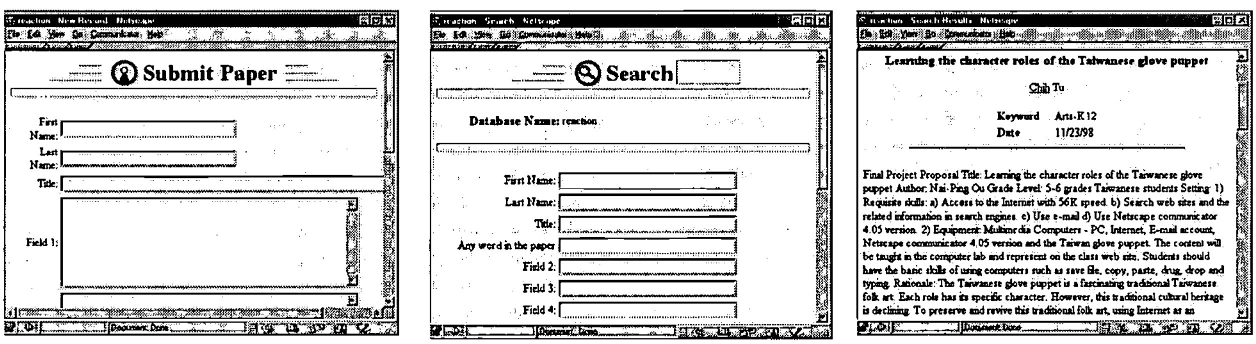

Figure 1: Assignment database

Online Grade Book Database

An online database can be applied to class management; for example, an online grade book can be created. Since the teacher can review student assignments on the web, grading is done on the web as well. Teachers post the grades and feedback on the web without HTML or spreadsheet work. Students' grades and feedback will be available for the students to view when posted by the instructor. The total points earned to that point is also computed after the teacher enters the new grade (Fig.2). When the grades are entered, the students will be notified via an automatic e-mail generating function. Teachers are not required to compose separate e-mails to notify students that their grades have been posted. Teachers also have different formats to view students' grades and feedback, individual student view, and a list of students. This gives teachers an improved, flexible method to manage their class. In the student online grade book, separate from the teachers' grade book, but using the same database, students are required to enter their student ID number to obtain their grades and feedback. This design provides a high level of interaction and personalized information immediately. Students can view their previous grades and feedback, thus obtaining a comprehensive status report.

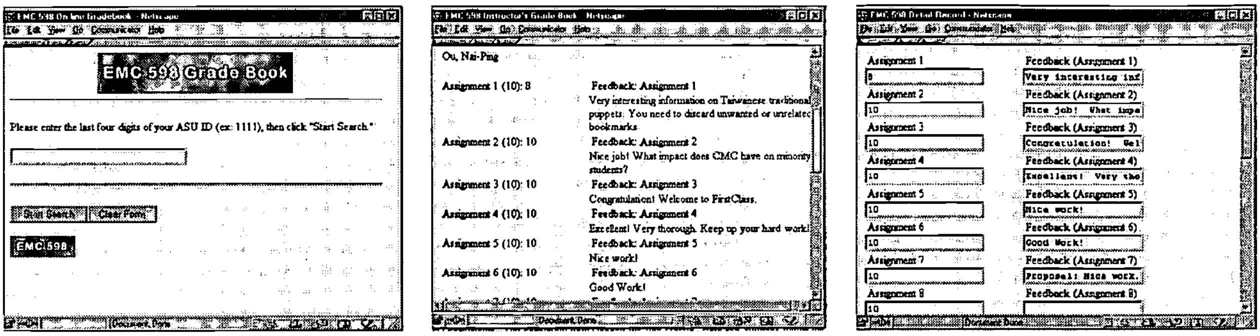

Figure 2: Online Grade Book

Final Project Database

The final project database is the most complicated design in this course. It contains several sub-databases, which provide different functions and management. In this course, students created a web-based instruction and FTP on a web server. The process requires students to post project titles, URL, keyword on subject, and keyword on audience. This process is completed on the web (Fig.3). A web page allows students to view the list of project titles with hot links to the students' web sites. Students are also able to make updates, edit, or change the information they submit. The self-management feature is utilized throughout this database. Peer evaluation is employed in the final project. Students are asked to evaluate five other students' final projects by using an online evaluation form (see fig.). Students can work at their own pace to complete their final project evaluations. This evaluation form contains four criteria. Basically, students follow the criteria to give scores and feedback. In the evaluation form, the project author's name and evaluator's name are required. This gives the instructor the opportunity to determine who has provided evaluations of whom, very important information for the instructor. After finishing the evaluation, students click the submit button to submit their evaluation to the database.

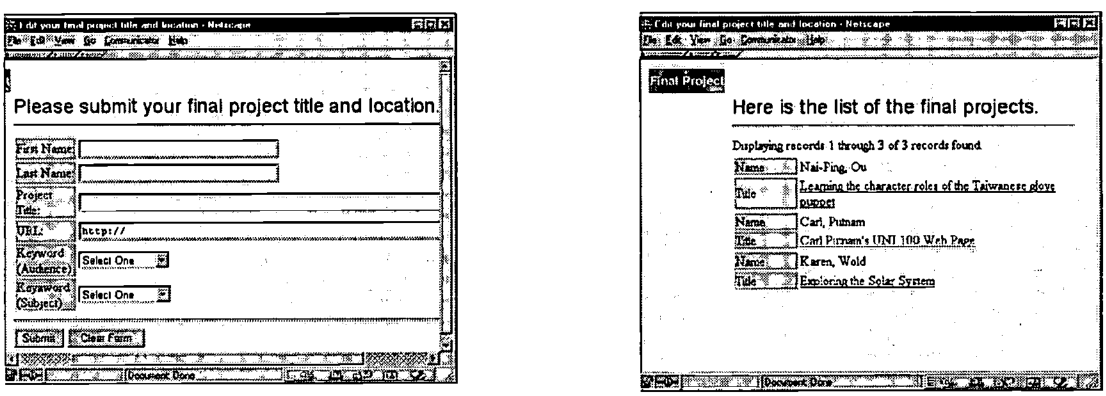

Figure 3: Final Project Database

The second part of the final project database is viewing the evaluations. After students provide their evaluations on other students' final projects, they are able to view their score and feedback right away. Students are able to see all of their evaluations immediately, after they have been submitted. A number with a paragraph, which explains the evaluation status to the students, is located on the top of the page. This gives students a very clear picture of the evaluation status, and they have the opportunity to know how well they are progressing constantly. Eventually, students should be able to see all five evaluations. The results of these evaluations provide scores, feedback and the total score and average score of the five evaluations. The same process is used to view the instructor's evaluations with the total score and average score (Fig.4).

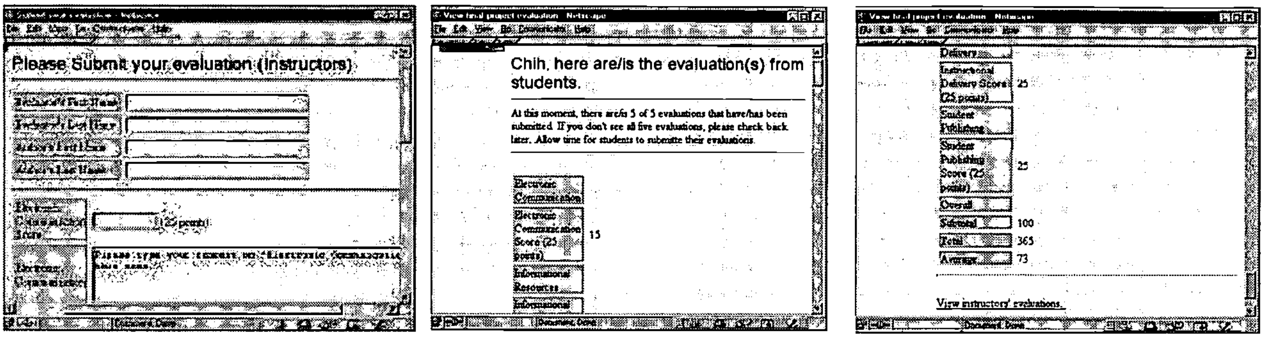

Figure 4: Database Links

The third part of the database is its most powerful element. The scores shown in the student and instructor evaluations are connected to the grade book database. Whenever someone submits a score to the final project database, the students' final project score will be updated immediately with a pre-scripted calculation. For example, the students evaluation is 50% of the final project score and the instructor's evaluation comprises the remaining 50%. When the final project score is updated from evaluations, the students' grades are updated immediately. Since this is a pass/fail course, the students will see their grades with their status. The final-project is an excellent example of self-contained management in a database-driven instruction (Fig.5).

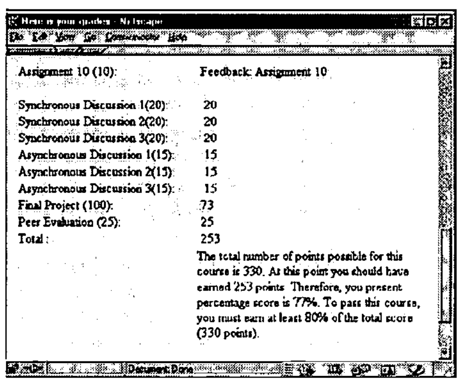

Figure 5: Interactive Database Messages

Security

Security is another reason to use a database. If the database is running on a server, it will be automatically backed-up on a regular basis. In other words, it is safer than on the teacher's computer, which is rarely backed-up. Although the database is running on a web server, a regular backup can be scripted on the FileMaker Pro to backup the important database and files. The access log is another security feature. Whenever the database has been accessed, it will be kept in a log file, which can provide a reference for statistical analysis. If security is extremely important, the database can be scripted to a limited access location, such as an identifying IP address.

Software and Hardware

The database utilized in this class does not require extraordinary software or hardware. The central piece of software, FileMaker Pro 4.0, was installed on a PowerMac 7200/100 with 32 MB RAM and a constant Internet connection, which is not a web server. Two HTML editors, Claris Home Page and Page Spinger, were used to create HTML pages. HTML editor is not required to produce database-driven instruction if the person plans to use codes. However, Claris Home Page provides seamless integration with FileMaker Pro on the HTML creation.

Hardware requirement (FileMaker Pro, 1998) for installation of filmmaker Pro is:

MAC

A Macintosh or Mac OS computer with at least 8 MB of RAM (16 MB or more recommended)
A CD-ROM drive
System 7.1 or later, or Mac OS 8 or later

PC
An Intel-compatible 486/33 PC or higher with 8 MB of RAM (16 MB or more recommended)
A CD-ROM drive
Windows 95 or Windows 98, Windows NT 3.51 or later, Windows for Workgroups 3.11, or Windows 3.1

A constant Internet connection is highly recommended for web publishing. A dial-up connection works but it may not be as efficient and reliable as a constant Internet connection. The number of users is another important issue to examine in terms of hardware requirements. If the database will be accessed by large numbers of users, a more powerful computer is recommended. There were about thirty students in EMC 598, the PowerMac 7200/100 was efficient enough to process all student data, requests and accesses.

Discussion

This database-driven course instruction will be expanded to a full-scaled database-driven course in the future. Course schedules, all assignments, course content, class announcements, joint database with other courses, integration with CGI/Perl will be included in future iterations.

A course schedule database will allow instructors to create, edit, and update course schedules interactively. HTML coding is not required. The schedule will embed with hyper links to make it more interactive.

Assignment database will be applied to all assignments. This will increase student-publishing power and enhance critical thinking and information searches. After several semesters, the database will contain a large amount of searchable information. Students will be able to benefit from this instruction with easy access, not complicated by the necessity of learning more technology.

Course content database will assist instructors in developing and organizing the content of their course(s). Currently, most instructors have their course content in computer files on the their hard drive without any connection. This disorganization creates difficulty for instructors in joining their content. With a content database, instructors can very easily assemble course content, particularly for individual learning instruction. Instructors are aware of the importance of individual learning instruction; but it has never been truly implemented because of the time required. With database design, instructors should be able to design an instruction suited for individual student needs in a timely fashion, a minimum amount of searching would coalesce the content.

A class announcement database is a good tool for class communication. Instructors provide the announcement with a date and post it on the browser. With database scripting, the announcement can be controlled by the instructors' wish. For instance, with minimal scripting work a new announcement will be seen by the date designated by instructors and retired on the date specified. Updating and deletion of the announcements is not required. Instructors can prepare all of the announcements for the entire semester and post them at the beginning of the semester. This feature will help instructors to remember all announcements.

A joint database with other courses will increase the power of database-driven design. It simply expands the size and amount of the database.

With the integration of CGI/Perl or other programming, the database will be more useful, interactive, and secure. However, with programming integration, the concern will be creating more advanced skills for teachers or instructional designers. A database-driven course design doesn't require teachers to have a great deal of familiarity with technology. However, it creates a tremendous amount of work for the database designers or instructors. Filmmaker Pro provides user-friendly interfaces to anyone that has some basic HTML and database design experience. Involvement with web programming creates different issues of design. It is suggested that if someone is planning to integrate a database into their instruction, several questions must be answered in advance: What do I want from a database-driven instruction? Why do I want it? How much do I want it? How much time and support

will I have? Database design can be extremely expensive and frustrating without thorough planning. The concept of a database is planning and taking advantage of it later. Anything involved in redesign or restructure of a database can be very costly.

FileMaker Pro is not the only database available. In terms of the scaleable issue, other products, such as Oracle or Sybase, may provide a more thorough, secure, and scaleable program. However if cost is a major, FileMaker Pro is inexpensive, unlike Oracle or Sybase.

Conclusion

Database-driven course design is a new way to manage and re-examine our instruction designs. Critical thinking, constructing knowledge, learner-center instruction is a new paradigm for instruction design. In the past few years there have been multiple developments in educational technology. Instruction design should take full advantage of database technology to provide a more interactive learning environment.

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TELECOMMUNICATIONS – PRESERVICE APPLICATIONS

Electronic Portfolios: Why? What? How?

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Abstract: Prospective employers and external accreditation agencies today expect preservice teachers to fully document their success in a teacher education program. Missouri Western State College moved from the "scrapbook" portfolio to the WEB delivered electronic portfolio in three years. This paper explains why MWSC chose to bypass the CD delivered portfolio and move directly to a portfolio that is created using Netscape Composer. The paper discusses problems encountered with the electronic portfolio and how MWSC chose to resolve those problems.

Why portfolios?

Several years ago the Department of Education at Missouri Western State College {MWSC} began hearing about portfolios. Students were urged to begin making a portfolio. Initially, "portfolio" was associated with a scrapbook that included "things" that had been saved and which could eventually be shown to a prospective employer. The early portfolios lacked organization and structure but they were used by prospective employers to help select beginning teachers and MWSC graduates did gain employment because they had a "portfolio."

Eventually the "things" became more refined so that an organized three-ring binder would include a resume, references, letters of recommendation, transcripts, educational philosophy, classroom management theory, personal goals plus lesson plans, unit plans, printed technology examples, assessments and personal reflections. Many portfolios included photos to illustrate examples of lessons and the congruency between what was being said and what the student teacher actually did in the classroom. Again this refined portfolio was informally done and was used only for employment purposes. Doty and Hillman {1997, p. 776} explain the early development of the preservice teacher technology portfolio.

What is a portfolio?

The MWSC faculty also began to refine the definition of what a portfolio really is. An excellent description is offered by Paulson, Paulson, and Meyer (1991). They describe a portfolio as "A purposeful, integrated collection of student work showing student effort, progress, or achievement in one or more areas. The collection is guided by performance standards and includes evidence of students' self-reflection and participation in setting the focus, selecting contents, and judging merit" (p. 295).

MWSC welcomed the idea of having students develop a teaching portfolio. It was believed that the completed portfolio would be a tangible collection of a student's best work that was a result of a complete and full teacher education program. The student portfolio would provide both faculty and school administrators with examples of what a student could do rather than merely rely upon a transcript of grades or formal evaluation forms. Though an examination

of the portfolio an evaluator could begin to easily determine if there was a connection between philosophy and practice.

The department could assess the strengths and weaknesses in the teacher education program with student portfolios. Prospective employers could use the portfolio to help select first year teachers.

Early it was learned that the notebook portfolios were not ends in themselves but a working tool that students could use when reflecting about their knowledge, skills and attitudes about teaching. The new portfolios included the above items as well as an explanation of how and why each item in the portfolio illustrated good teaching. Exceptional student teachers simply began documenting their successes in the classroom and the college campus.. The development of the teaching portfolio easily became part of the MWSC field-based, performance-based, reflective model of teacher education.

A new meaning for "portfolio" was developed when it was learned that accreditation agencies as the National Council for the Accreditation of Teacher Education {NCATE}issued new guidelines for teacher preparation and would be using the new standards to assess the strengths of the MWSC Department of Education {Thomas, 1994} . Associated with the new guidelines was the idea of the electronic portfolio. Several major issues arose with this new use of the portfolio:

- where would the department store all of the three ring binders
- how would the department deal with the students who wanted to take their lesson plans, unit plans, assessments, etc. when leaving MWSC

The "notebook" portfolio no longer would be suitable for the new uses of the portfolio. Jackson {1997, p. 698} explains the trade-offs of the traditional portfolio vs. the electronic delivered portfolio.

How are portfolios produced?

Technology. "Why don't we just put the portfolios on a CD?" An easily stored electronic portfolio would solve all of the storage problems, allow the students to take their materials with them and could then be used by the students for employment purposes. Programs as HyperCard, SuperCard, Multimedia Director or HyperStudio could be used to develop non-linear links for the electronic portfolio. The CDs could be archived and easily used by external evaluators. The electronic CD portfolio would meet the needs of the department.

Reflection soon indicated, however, that the CD ROM electronic portfolio created as many problems as it solved. Once made, it would be difficult for a student to update the portfolio if the student no longer had access to the college provided software and hardware. Licensing or purchase of production software plus the necessary hardware would be very expensive. Incompatibility between the equipment at MWSC and the equipment in the area schools would make the CD useless to many students. Questions arose as to how many copies of the CD portfolio a student might need. Jackson {1997, p. 700} highlights the limitations of creating an electronic portfolio on a CD.

The idea of the CD electronic portfolio was quickly replaced with the WEB portfolio that could be developed using the HTML editor found with Netscape Communicator/Composer.

Netscape Composer was selected as the appropriate software because all computers in the departmental computer lab already had this gratis program. All students at MWSC already have a free Internet account through the college so each student has a place to house the electronic portfolio. Many students are connected to the college account via a modem so the electronic portfolio can be developed any of twenty-four hours per day. Netscape Communicator is a free program that can be downloaded so students can continue to update and revise the electronic portfolio after leaving the college. Other html editor programs might make it possible to produce a more elaborate WEB page; but, availability of the program after leaving MWSC again was the concern. With little technical knowledge a person can produce a very acceptable WEB page with Netscape Composer.

Earlier the idea of a floppy disk portfolio had been rejected because of the limited storage capacity of a disk. As the portfolios become more sophisticated and include video clips, the 1.3MB floppy definitely would not meet the needs of students.

A WEB based portfolio also would eliminate the problem of "how many CDs should I make?" An employment scenario might go like this: student visits a school superintendent with a brief resume that lists the URL [WEB location] of the electronic portfolio. The superintendent calls a school principal or department chair and says, "I think we have a person we might want to look at in depth. Please look at this candidate's WEB pages that contain the portfolio." Without the WEB portfolio the candidate must leave a CD and the school personnel must then shuffle the CD from one office to another or from one side of town to the other side of town. This can take several days. The WEB based portfolio eliminates the need to produce five or fifteen CDs that might be needed for employment purposes. The WEB delivered portfolio is available within minutes to prospective employers and on a twenty-four hour basis.

External program evaluators will also be able to review student portfolios prior to the arrival on campus, in their hotel room or when they are on the MWSC campus. Again, the Internet delivered portfolio reduces the need to orchestrate the moving of CDs from one evaluator to another.

All elementary education students at MWSC are required to take an instructional technology course. During this course students create two WEB pages: one using the manual inserting of html tags into a document and one using the HTML Netscape Composer editor. Production of the above WEB pages require students to become familiar with basic WEB page production and composition, image transfer, FTP, scanner software and digitization of photographic images. [Secondary education students, however, are not required to take the instructional technology course.]

The production of the WEB based portfolio becomes a logical extension and real-world application of skills previously learned in the required elementary education technology course. Many students are able to adapt previously developed WEB pages to the final electronic portfolio or they merely create a hyperlink to the earlier WEB pages.

The above plan was implemented during the fall semester of 1998. All fall student teachers were required to complete the electronic portfolio before the end of the semester. The secondary student teachers quickly and easily were able to complete the project using Netscape Composer. Composer eliminates the need to learn all of the necessary html tags.

As compared to the earlier "three-ring notebook" portfolios, it appears that the quality of the electronic portfolios has moved to the positive side of the ledger. The electronic portfolio has the potential of being viewed by a greater number of people. Thus, greater effort and pride was taken to create a public document. Today most prospective employers are interested in assessing a candidate's technology skills. The electronic portfolio easily allows this to happen.

The appropriate WEB pages that illustrate the Missouri Western plan are located at the following URLs:

- http://www.mwsc.edu/~edtech/webpage98.html
- http://www.mwsc.edu/~porr/port/webpres4.html

Results of the required electronic portfolio assignment

About the time we think one or two problems are solved new ones develop.

One major problem faced by the faculty was the idea of the electronic portfolio itself. Students had been told for several years to develop a "notebook" portfolio. Some students resist doing things a new way and saw the electronic portfolio as an infringement upon their time during a busy student teaching semester. Immediately the required elementary instructional media class will be adapted to insure that the basic format and structure of the electronic portfolio is completed prior to the student teaching semester. It was further noted that the required electronic portfolio required students to make a direct connection or integration of the knowledge and skills learned in the earlier technology class to a finished product that was part of another class. Earlier students had failed to connect "technology" to anything but the technology class. New ways of thinking had to emerge.

Students who did not have a home computer or who were student teaching a far distance from campus found it difficult to complete the final electronic portfolio. The assignment for these people required trying to get into a computer lab during the evenings or weekends. For the majority of the students, however, the WEB based portfolio was easier to complete when compared to a CD portfolio that used less available hardware and software.

Early in the semester "privacy" became an issue. Several students strenuously objected to having personal data, letters of recommendation, evaluations, etc. in the public domain or on all computers in the world. To counter this concern it was suggested that the student create a subdirectory that used a very unique name for the electronic portfolio URL. The URL would be available to only those people that the student chose to give it to.

Competition for employment can be very challenging. Several students expressed a concern about having their peers simply copy, wipe and paste html codes from someone else's electronic portfolio to a "new portfolio." The more technically skilled or motivated students

had a concern that the seemingly open portfolio would jeopardize their employment possibilities.

Computer literate students asked about aggressive search engines that can find almost any web page. Unless a student specifically registered a WEB page with a search engine it may take several months before the existence of the page is known to the world. [And by that time the student will be employed.] Because of the "privacy issue" no MWSC student produced WEB portfolio is available for viewing.[1]

The issues of privacy and plagiarizing will be resolved for the spring semester of 1999. Entry to all electronic portfolios will require a protected password.

For whatever reason it may, some students might zap the electronic portfolio before it can be viewed by program assessment evaluators {NCATE and Missouri State Department of Elementary and Secondary Education}. To insure availability two or three years in the future, all electronic portfolios will be converted to a CD that will become part of the departmental archive. A trained workstudy student is able to burn a CD in less than five minutes.

MWSC students have 5 megs of computer space for housing both email and WEB accounts. Some of the produced WEB pages are very elaborate with many graphics. This has resulted in several students exceeding their computer space allocation. After graduation the student loses this free account. The lack of space and the closing of the account were unanticipated problems. Each problem will be solved when the Department of Education sets-up its own server before the spring 1999 semester. The department will be able to store several years of electronic portfolios on the new server. MWSC will be able to continue to provide a service to its graduates by making the electronic portfolio available to prospective employers.

Students were encouraged to use photographs to visually present various parts of the portfolio. The department purchased digital cameras for this purpose. Digital cameras were quickly replaced with the student owned 35mm cameras and film. {Most students could not predict exactly "when" the best time to take pictures of classroom activities would be.} Thirty-five mm film can be developed and digitized for less than $10 per roll. The photos can then be ftped to the student web page file. Using student cameras eliminated the problems of not having enough digital cameras, record keeping, not having the camera right day and the eventual problems of having cameras used by so many people. Students with advanced computer skills can enhance photographs with programs as Photoshop.

Success

Three years ago the idea of "portfolio" caused alarm in our department. As the semesters go by we will continue to deal with additional problems that are yet to be faced. For the present time, however, the electronic portfolio created by Netscape Composer seems to have provided solutions to what seemed to be an insurmountable problem.

An overview of the MWSC Web Portfolio can be found at

- http://www.mwsc.edu/~porr/port/webpres4.html

[1] Preservice and Inservice Teaching Portfolios can be viewed at http://curry.edschool.virginia.edu/curry/class/edlf/589_004/sample.html

A word of caution: there is a distinct difference between an electronic portfolio that might be used by a student for employment purposes and the portfolio that will be required by NCATE and/or state agencies who are interested in program review. The production processes can be the same. A student might elect to duplicate some of the basic content but in all probability the majority of the portfolio will contain different information. The similarities and differences between the two types of portfolios are beyond the scope of this paper.

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A Constructivist Approach for Introducing Pre-Service Teachers to Educational Technology: Online and Classroom Education

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Abstract: The goals for our preparation of pre-service teacher educators in educational media and technology include the development of pedagogical ability as well as technical knowledge and skills. Pedagogically we adopted the goal of teaching the students to use technology to facilitate a constructivist approach to teaching and learning. We have developed a classroom-based and online courses in which we immerse students in educational media and technology. In this paper we provide accounts of our experiences in the implementation of these constructivist learning environments.

Eastern Michigan University prepares more educational personnel than any other university in the country. Along with cars, the state of Michigan exports teachers to the rest of the country. Standards recently adopted by the state for pre-service teachers state that new teachers should be able to use technology effectively in teaching/learning and as a personal and professional productivity tool. The state's Council for Pre-service Technology has adopted a framework for treacher preparation and educational technology. Carl Levin, U.S. Senator from Michigan, is sponsoring activities aimed at establishing Michigan as a national leader in the infusion of technology into classrooms thoroughout the state.

It was in the midst of this serious discussion of pre-service teacher preparation and technology that we undertook to create a new course for EMU students to address pedagogical and technical skills to use infuse media technology throughout their curriculum as teachers. The guiding principal in the development of the course was that pre-service teachers realize the potential that technology has to facilitate constructivist, student-centered learning environments. It was essential that we create a learning environment for our students to learn about media and technology that would reflect how we hoped they would later use technology to facilitate learning in their own classrooms. In order to achieve that goal we have developed parallel student-centered learning environments, one classroom-based and the other online, in which we immerse students for their training in educational media and technology. The purpose of this paper is to share our experiences in the development and implementation of these constructivist learning environments.

Constructivists believe that the way we learn is by interpreting our experiences based on our prior knowledge, constructing meaning and later revising our understanding by reasoning through new experiences. Knowledge must be constructed, not transmitted (Jonassen, Peck and Wilson, 1999). In a constructivist learning environment, students should be engaged in activities and assignments which are authentic tasks embedded in rich, real world contexts. When possible the audience for those tasks extends beyond the classroom, and assessment is performance-based and reflective. The relationship between the instructor and the students is one of cognitive apprenticeship, in which the instructor models problem solving, engineers learning experiences, provides scaffolding as students attempt tasks, and encourages reflection. Working collaboratively and using original source materials when possible, students constantly confront multiple perspectives on the content being learned: their own, other students' and multiple experts' including the instructor's. Students are encouraged to reflect on their experiences and their learning as it progresses.

To implement these concepts, we designed a new professional education course as part of our elementary and secondary teacher education programs, one focusing on pedagogy of teaching with educational media and technology. Since construction of new knowledge rests on the bed of prior knowledge, prerequisites

include a basic skills computer course and a curriculum methods course. The course itself is a simulation, with each student being hired as a teacher at a specified grade level and in a specified content concentration if the grade level is grade six or above. Tasks require that "teachers" participate on a school-wide committee to create a weeklong, school-wide, thematic unit on a decade of the twentieth century (Sandholtz, Ringstaff, & Dwyer, 1997), to demonstrate instructional planning for technology infusion. At the classroom level, students create a variety of media/technology products such as a PowerPoint presentation and a multimedia, self-instructional lesson. As a member of a district-wide committee, the students confront an ethical issue which arises related to internet usage by students in the district and, working collaboratively, make recommendations about district policy and staff development. Students reflect on their learning in a journal and, using their work from the course, create a professional electronic portfolio documenting their knowledge and skill in using technology in teaching and learning.

The online version of this course (**http://www.emunix.emich.edu/~abednar**) has been taught twice by one of the presenters, with that same presenter teaching the classroom version once. The classroom version has also been offered two more times by the other presenter. By way of comparison, both presenters have taught multiple sections of earlier media and technology courses which were not built on a student-centered constructivist model. We collected data from each of these course formats in order to analyze student products and reflections from the new course and examples of student assignments and course evaluations from the earlier courses. In addition, we have analyzed our personal reflections about the progress of the course and of individual students and groups in which they participate.

The question we are seeking to answer ultimately is whether there is a difference qualitatively in the ways students choose to use technology in the classroom when they learn to use educational technology in a constructivist learning environment. As with many questions in teacher preparation, the answer lies in a long-term study in classrooms of the future when these pre-service teachers mature. Meanwhile we can make observations contrasting their performance in class to that of previous classes. We would not characterize our findings so much to be an endorsement of a particular approach or medium as much as an inquiry into the strengths and weaknesses of a new approach.

Interestingly enough, the two faculty teaching the course had rather different experiences with their first teaching of the new professional education course. In the following they will both discuss their experiences and then hypothesize explanations for the differences.

Faculty Member Number One: Anne

I developed both the online and in classroom syllabus for the new course. This semester I taught two sections of the new course (one online and the other in the classroom) and four sections of the older non-constructivist media course. Some of the key constructivist elements, which I tried to include in the new course, were:

- Authentic tasks – assignments based on real world tasks that students will eventually perform as teachers for their classrooms, schools and districts, using technology and software that they may expect to find in state-of-the-art schools technologically.
- Collaborative work groups akin to school committees for curriculum development and problem solving activities.
- Reflective thinking to synthesize readings, individual and group projects, and the perspectives of peers, instructor and various experts.
- The instructor's role as a resource, to structure and guide learning experiences and model task performance.

Of these elements, only the first is in any sense an element of the non-constructivist media course; that is, some of the products that students create in the media course are similar to products assigned in the new course but without the unit context as a focus.

From early in the semester I noted differences in my classroom section of the new constructivist course as compared to the sections of the other media course. The constructivist course met twice weekly, and from

the first day I had them assigned to collaborative work groups; they were representing a committee of teachers in a curriculum development project and were divided into interdisciplinary groups were at the elementary, middle or secondary level. The majority of early class sessions were team meetings either to get started on the unit development project or to assist each other with challenge assignments as they developed new skills with technology. I occasionally did a demonstration in front of the whole class, but more often coached them as they worked to achieve goals as a small group.

In the media classes, the class was taught as a body of the whole; when small groups were used, they were for a single class period only. The dominant pedagogical approach was demonstration while students worked hands-on at their own computer stations to follow along with me. Interspersed with demonstration were mini lectures/discussions to link the technical skills, which were being developed to pedagogical approaches.

At one point, about four weeks into the semester, I used a similar computer-based draw/paint group activity, one involving generation of masters for an overhead transparency and overlay, in all the sections of both courses. I expected the media sections to do better on the project, because I had devoted more direct teach, in-class time to developing draw/paint skills in that course than in the new course. The opposite occurred. The only class to finish the problem was the new course, and all four small groups within that class finished with a high quality product. No group in the media sections finished; they had difficulty figuring out how to start the task, and when faced with a false start they could not adjust but rather needed to start from the beginning again. My interpretation was that the students in the media classes were unable to work independent of my demonstration; they needed to be told each next step to do.

Later, when the homework assignment related to this in-class small group activity was due, all but one of the students in the new course successfully completed the assignment and many were high quality products that I would be pleased to use in a classroom. About a fourth of them also included technically complex graphics at this early point in the semester. In the media course, many more students (4-6 per section) achieved the product only by successive approximation, that is, submitting a product, receiving feedback, and resubmitting the product at least a second time. Out of twice the number of students, only two used complex graphics on their transparencies.

The other characteristic of this product (again, the first assignment of the semester) was that the products turned in by students in the new course were good choices of real ways in which to use transparencies in the instructional process, while often those turned in as part of the media course were the minimum required to meet a passing grade and did not represent materials that most teachers would choose to use in actually teaching the content covered. The students in the new course had been required to create a product, which could be used in the teaching of the interdisciplinary unit they were developing. They had already worked fairly extensively to identify resources for the units and to set the unit goals and objectives. In contrast, the students in the media class had been required to create a transparency with at least one overlay that they might use in teaching a content they might teach in the future. Several of these transparencies from the media course were artificially divided into two parts to meet the requirement of an overlay with little thought about the actual teaching. I credited this difference to the reflections required of students in the new course but not included as part of the media course. In these reflections, both the in-classroom and the online students in the new course were asked to reflect on questions critical to the use of technology in the classroom. We had already discussed in depth the various rationales for use of technology in schools and had developed a decision framework requiring that technology be used only when it enhances learning rather than just for the sake of using technology. As one student reflected: "The teacher must know before hand if the use of technology will boost student learning and achievement. I will approach lesson planning with the most emphasis on what is important for my students to know rather than what video or other use of technology fits into this unit. Assessing student learning will determine if I choose to include this type of technology again."

I saw evidence of these contrasts between students in the two courses frequently throughout the semester. For example, when preparing their multimedia lessons near the end of class, quite a few students in both the new course and in the media course found that their scanned images required so much memory that they could not save them on their disk as part of the lesson. Two students from the new course recalled that

I had said JPEG files from the Internet required less memory than other, more dense, graphic formats. Instead of asking the lab assistant how they could solve the problem, they asked for help in saving the scanned image file as a JPEG. At the beginning of the course neither of these students used a computer for anything other than word processing and neither had a home computer. They seemed to take the problem as an opportunity to learn rather than a reason to give up. I did not see this kind of attitude generally in the media class where problems were likely to result in defeat until specific solutions were given.

Another characteristic which is generally different between the classes is the pride which students in the new course, both in the classroom and online, show in their work. At times I tried to discourage fairly lofty goals anticipating problems they would cause along the way. Students in the new course insisted on going ahead, however, and have been extremely proud of their ability to get things they way they wanted in spite of limitations of technology. One several occasions they have commented on using work from our course in another course as well and the success of their work to that extended audience.

Of course there were some excellent students in the media courses and some less capable students in the new course, but generally I was more pleased with performance in the new course. I wondered whether my observations were biased, but a colleague who visited the course several times also noticed the difference between this group and students in my previous media and technology courses he had visited.

Reflecting upon these differences as we moved through the semester I concluded that the students in the new course were: more independent as learners, more confident in their ability to handle challenges while using technology, and more conscious of the applications of the things we were learning in a school context. It occurs to me that two possibilities exist: either EDMT330 has influenced these groups of students to talk about and work with technology and its use in schools in a much more mature way than my other undergraduates, or I have simply had exceptional groups of students (20 in the classroom and 20 online) in this first semester of the course.

Faculty Member Number Two: Mike

I taught the classroom version of this course for the first time this semester as I began my second year of teaching at the university following a decade and a half of teaching in K-6 schools. This semester I taught two sections of the constructivist course (with approximately 20 students in each section), using a syllabus that was developed from and similar to Anne's. Both of these sections were classroom courses (i.e. I did not teach the course online), taught in fifty-minute sessions, one period after another, in a class that met twice each week. I was also teaching much of the same content in an introductory course in our educational media and technology graduate program. I did not teach any sections of the older non-constructivist media or computer courses this semester, so I could not directly compare work between the two courses.

Like Anne, I tried to incorporate key constructivist elements in the new course. An emphasis on authentic tasks meant that assignments were all related to a thematic unit about one of the decades of the 20th Century. Students did much of the work for that unit in collaborative work groups. Opportunities for reflective thinking to synthesize readings, projects, and different perspectives were provided, though not as frequently or with as clear a focus as was the case in the Anne's section of this course. Likewise her emphasis on relating to the students more as a resource, with less of an emphasis on direct instruction was not something that was pursued with the same energy. My focus frankly was more on figuring out how to put together these two courses that had taught separately in a less-constructivist fashion into one course that could be taught successfully in a more-constructivist way.

So perhaps it is not surprising that our experiences in teaching the course were rather different. Anne has described a marked difference in the quality of the work she received from the constructivist course compared to the non-constructivist course. Most notably she found evidence for what some might call more learning with less teaching (Papert, 1993). But I was much more discouraged by my experience in teaching the constructivist course. According to student reflections, they built a stronger bond of community through their group work. But generally speaking, I did not see better quality work from the students in this course.

One of the first warning signs came in the opening weeks of the course. Students were to choose a decade from the 20^{th} Century, and write a list of unit objectives and a content outline that pertained to the content from that decade they decided to teach. The quality of objectives and content outlines that I received varied greatly, with more than a third of the groups receiving very low scores and notes to revise and resubmit their work. Even the revised work was not particularly strong. Students were required to have taken a curriculum course prior to or in conjunction with taking this course, so unit design was not supposed to be new. But for some this did not come easily at all.

As the semester continued, several students made individual appointments with me, asking if they could complete some of the individual assignments for the course (such as software evaluation) apart from their decade. They had not understood that the whole course was structured around the unit despite my instructions. When they began to do materials evaluations of various media and computer programs, they did not want to be limited to looking only for materials that pertained to their decade of the 20^{th} Century. I allowed them to look at other materials that they specified from their own major. In fact I announced that for the software review, they did not have to limit themselves to their decade, since decade-specific software is rather hard to find. But this created a more serious problem that persisted throughout the course. In fact even up to the last class session, as students were working on various assignments such as creating a newsletter or a Hyperstudio presentation, I was asked, "Does this have to relate to our unit?"

One place where the difference in our experience came most clearly into view is in the overhead transparency assignment described earlier in this paper. We first did an in-class exercise of using a draw program to create a volcano and using a paint program to create a castle. This activity and its accompanying step-by-step directions were well received by the group. Some of them did not need such specific help and I encouraged them to use their prior knowledge of these programs to complete their work. But in the second session, few of my students were able to complete the draw/paint group activity of preparing a sample multilayered display in class. Then the overhead transparencies turned in as independent work, relating to the unit, again varied greatly in quality. In particular, a number of them (about 4-5 per section) were simply unusable due to either the size of the font or graphics or the way they were constructed. Some of these had to be revised and resubmitted several times in order to receive credit. This is precisely the same experience Anne had with her students...but in the non-constructivist course!

By the end of the course, I was particularly concerned about how well the unit plan idea had worked with our students. I asked for some direct feedback about this aspect of the course, noting that this was my first semester teaching the course and I wanted to improve it in the future. In an electronic bulletin board environment, I asked them to discuss the strengths and weaknesses of using the thematic unit approach to tie together the assignments for the course. I then asked them to suggest any ways that this unit approach could be improved in future offerings of the course.

The reflections of all forty students can be summarized in three points:

- The students really enjoyed working cooperatively in groups for the most part, with the only problem being getting together outside of class in a "commuter" university.
- The assigned decade approach was not so strong because it limited the applicability of the material that they prepared for future use. The decade scenario, though interesting, seemed too unlikely for future use. There was one group in particular, however, who really thought the decade approach worked well; they consistently did among the best work of both classes.
- In the future, allow groups to choose their own unit topics that could relate to other courses they are taking or would relate more closely to topics they will teach in the future.

As the professor in the course, I was honestly pleased at how many of the students, despite their criticisms, also mentioned that they thought the course was very valuable (though labor intensive). My own impressions of the student's experience had not been so positive. I did not realize that the groups seemed to function as well as they did, though this is perhaps in part due to the fact that one group in particular had serious problems that required a great deal of my energy to resolve. Also, this was my first time teaching this course, and I believe that I taught the second section much better than I taught the first section by virtue of simply having a better understanding of the content and pedagogical issues.

There were areas in which I did see better work this semester. In my course, I ask for fewer student reflections than Anne, preferring instead for them to read two articles with divergent views about the promise of educational technology (specifically computers) in the schools (See Oppenheimer, 1997; Starr, 1996). They wrote a summary and response to the arguments of the articles. The papers that I received for this assignment were among the best I have read to date. Many more students understood the subtle points of agreement between these two positions while locating the clear points of departure between the two. In addition, more of the students supported their own responses to the articles with factual statements taken from the text, in contrast to merely stating their own opinions without support.

So in a sense, my students seemed to have a positive experience with at least two of the constructivist elements mentioned initially by Anne: Collaborative work groups and reflective thinking to synthesize readings. They had serious questions about the authenticity of the thematic unit task in the long run, questions that are not without merit. But the most striking difference between our class was in the question of the instructor's relationship to the students. I had occasion to visit Anne's constructivist class section several times during the semester. I was impressed with the level of independence of her students in comparison to other classes that I have taught and in comparison to other classes I have observed her teaching. I vividly recall the day she met me in the hall, noting just how well the students had understood a particular computer application and just how little direct instruction she gave them. Working in groups they solved the problems that came up. As she stated earlier, the students in her course saw problems that came up more as opportunities to learn than reasons to give up.

Ownership and Authentic Tasks

Creating opportunities to learn is a main focus of a constructivist learning environment, and, while we have learned many things this semester, the experience of teaching the constructivist course has resulted in the opportunity for future exploration of many more questions. One of the main questions is that of ownership as it relates to authentic tasks: in whose eyes must the task (in our case, the unit plan) be authentic, the instructor's or the students'. We are exploring ways to maintain the collaborative group structure while devising a way to allow students more freedom in the choice of their unit topic.

The question of ownership has a second side, that of ownership by the instructor of the course they teach. We found clear evidence that the most successful activites in either of our courses were the activities we individually had worked to structure and for which we felt both ownership and commitment, the reflective paper for Mike and the challenge activities which helped reinforce the independence of the students for Anne. The partner issues of authenticity and ownership impact the motivation of students to learn and instructors to teach – two critical elements in any learning environment.

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Evaluating the Impact of Computer-Mediated Communication on Learning and Teaching

PANEL DISCUSSION

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Jeannine Hirtle will speak to the historical, theoretical and pedagogical background of computer mediated communication and the ways in which computer systems have and are redefining concepts of learning and teaching and the communities in which learning and teaching processes occur. At issue are the ways computer-mediated communication (CMC) affects the learning communities that shape knowledge in the classroom How do these cyber webs of personal relationships support learning? Do these cyber discourse communities have the potential to contribute to the teaching and learning process?

In order to support students in providing learning experiences that have the potential of transforming their cultural reality, providing discourse opportunities is an imperative. One of the prime goals our current work is to determine if the quality of discursive collaboration is enhanced by the connectivity provided through computer-mediated discourse. Studies which have reported the impact of computer-mediated discourse include ProjectH (Sudweeks & Rafaeli, 1997, www.arch.usyd.edu.au/~fay/projecth.html), a research project conducted over a twenty month period among investigators who had never met personally, but communicated and included 15 countries, numerous universities and commercial or industrial firms, and over 100 scholars. Twenty-three subsequent studies resulting from Project H have been conducted. (www.arch.usyd.edu.au/~fay/projecth/publications.html)

Studies concerning the social aspects of computer-mediated communication (Klemm & Snell, 1996, Wellman, et al.; 1996, Garton, Haythornthwaite & Wellman, 1997; Ngwenyama & Lee, 1997) speak to the cultural and societal impact of computer-mediated communication systems.

Larry Walker will describe the World In 2020 project and web site (http://wi2020.conroe.isd.tenet.edu), a secondary school based science project which uses threaded messages board for recording remote asynchronous communication between project participants, and the recent 1998 NCSSSMST Student Conference. Walker will describe the organization and structure of the threaded message boards and the processes involved in the construction and management of the communications system. In addition thee will discussion on the nature of the data that can be gathered from the threaded message boards.

Peter Cooper will outline a proposed project to extend the work of these studies by focusing specifically on the pedagogical impact of CMC within secondary and post-secondary educational environments. We seek to understand if technology can enhance the learning environment that provides those opportunities. In particular we ask the following questions:

- What are the effects of computer-mediated communication on the learning process.

- What impact does educational-oriented computer-mediated communication have on student attitudes toward technology?
- How does language, and specifically the language of our students when mediated by computer assisted communication, create or disrupt community?
- What is the impact of computer-mediated communication on student attitudes towards communication and collaboration?
- What impact does computer-mediated communication have on student attitudes towards learning?

The proposed project would employs both quantitative and qualitative tools utilizing a variety of data collection methods including:

- Computer-mediated communication, primarily in the form of threaded message. The threaded message board provides the opportunity for sequenced multimedia communication in both asynchronous and semi-synchronous modes. The content and structure of communication through the threaded message boards will be analyzed to ascertain how the process impacts both learning and teaching.
- On-line interviews of participants during the data collection phase will be conducted to elicit data on participant reactions to the CMC experience.
- Qualitative data concerning participant perceptions of the value of the computer-mediated communication learning process.
- A quantitative pre-post analysis of participant attitudes toward technology (Cooper, 1997) will be performed to identify changes in attitudes as a result of exposure to learning oriented computer-mediated communication.

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I'm Not Your Mother Duck
- The Downside Of Educational Technology -

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Like baby ducks imprinted to follow their mama, students who are spoon-fed knowledge in teacher-centric learning environments are trapped in limited repertoires. They may perform a limited number of academic behaviors, but their capacity for independent and inter-dependent thinking is seriously diminished.

The pervasive emphasis on using educational technology for DELIVERING information imprints students as passive learners (isn't television bad enough?). Where and how do we teach students to be independent learners who can find, assimilate, and apply information on their own? Where and how do they learn to create new information and insights?

Four years ago, we began testing an asynchronous Internet software collaboration system, FORUM (www.foruminc.com). This presentation demonstrates some of our uses of FORUM for individual and group work that goes beyond "imprinting the ducklings." Illustrated are examples of how to stimulate insight, creativity, and ability to organize and apply information.

Expanding The Horizons Of The Classroom

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Abstract: Telecommunication expands the horizons of the classroom, opening doors to real audiences and exciting interactive activities from locations around the world. Teachers will discover how to integrate telecomputing within existing curriculum framework using the components of the Internet. They will gain insight into ways in which to locate lesson plans, simulations, online and pen pal projects, listservs, newsgroups, and virtual tours via the Internet. Examples of sample lesson plans and student projects will be displayed.

Transmission of Teacher Dispositions: A New Use for Electronic Dialogue

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Abstract. This paper describes a project where three teachers served as virtual guest speakers to preservice teachers through an email-based electronic discussion group. One goal of the project was to integrate technology into the daily classroom activities of the students. However, one unexpected byproduct of the project was the modeling by the guest speakers of dispositions of effective teachers and their public reflection on teaching. The success of the project has led to a larger program, supported by grant funds, with 32 teachers and teacher education students from across the state.

Introduction

Imagine a professional development school and teacher education program where the teachers play an integral part in the preparation of future teachers. Each teacher has the opportunity to impact the learning and preparation of hundreds of future teachers and each pre-service teacher has the opportunity to interact with multiple veteran teachers. During these interactions, teacher education students can ask the experienced teachers burning questions related to current issues and practices in education. The teachers in turn have the opportunity to reflect upon their professional practice and share their professional development with future teachers, teacher educators, and their peers.

Although this may be happening at some professional development schools (PDS) and within the associated teacher education program, it is difficult to achieve the level of involvement without the inclusion of multiple teacher education programs and multiple PDS systems. The logistics of that task would be enormous. Fortunately, with the use of simple information technologies such as electronic mail and the World Wide Web (WWW), that type of K-16 learning community can be developed.

Recent articles in the *Journal of Technology and Teacher Education* have described the power of placing the voices and experiences of teachers online. Bosworth, Haakenson, and McCracken (1997) describe the use of a web publication to distribute teacher viewpoints to pre-service teachers and how these students grew in their understanding and comfort in dealing with various issues. Denise Johnson (1997) details a project where preservice teachers developed a greater understanding of reading philosophy through electronic dialoguing with practicing teachers from around the country. The relay of information can be an important outcome of electronic communication, as well as the demonstration of practical, integrated uses of the technology. However, can more be obtained and gleaned from these electronic dialogues? Can these electronic dialogues serve to not only have teachers use more technology while learning about the teaching profession, but also become more reflective practitioners and understand more about the dispositions that are an integral part of being a teachers (INTASC 1998; IPSB 1998).

Background

In order to understand the project described in this paper, and to envision the possible future forms of the project, it is equally important to understand the purpose behind the use of a virtual guest speaker program. The research presented here examines the literature behind the premises of technology use, reflective practice and dispositions.

The National Council for the Accreditation of Teacher Educators (NCATE) issued a report recently entitled *Technology and the New Professional teacher: Preparing for the 21st Century Classroom* (1997). This report describes the need for teachers to be able to understand the impact of technology on society. It describes how teachers need to adopt new roles which allow them to use technology to become more reflective and critical consumers, and that teachers must participate in activities that are delivered via informational technologies. Building upon this last point, the literatures points to the potential of information technology to enhance learning productivity as larger numbers of students are able to be reached at a lower incremental cost, and how technology allows faculty to accommodate individual differences (Massy & Zemsky 1995). Kozma and Schank (1998) posit that information technologies will increase the use of effective project-based learning by allowing students to converse with experts from around the world. Vicki Hancock (1997) concurs with that position through her evaluation of six classrooms that are actively using information technology to create self-initiated learning projects. These types of programs, that bring the technology directly into the regular activities of teacher education students, create an atmosphere which moves students from knowledge consumers to knowledge producers while at the same time moving from technology that is an adjunct to instruction to technology that is central in the delivery of course content (Pellegrino & Altman 1997). In this manner, the teacher education program as a whole is better able to increase the instructional technology skills of its students, while transmitting important pedagogical information. This transformation to technology-rich teacher education classrooms is new and the efforts are still experimental, but the importance of using technology as a vehicle for delivery of information is apparent.

One of the questions that emerged with the project is whether or not the process of learning from and through technology can be translated to another level of learning and professional growth, such as the development of reflection? Thoughtful reflection is a difficult process that must be developed and nurtured (King & Kitchener 1994). Donald Schön (1983 & 1987) identifies the important role that reflection plays in professional development and growth. A number of researchers in addition to Schön have discussed how reflection takes place on a variety of levels (Zeichner & Liston 1987; Zimpher & Howes 1987; van Manen 1977). The lower levels of reflection concern the reporting of factual information or descriptions of what took place during a situation. The higher levels are where actions and behaviors and the impact those actions had on others are examined. King and Kitchener (1994) provide a number of ways that reflection, which leads to a critical analysis of performances, can be fostered. Examples include the creation of multiple opportunities for students to examine different points of view reflectively, development of a learning climate that promotes thoughtful analysis of issues, and opportunities for students to make judgements and explain what they believe. The process of reflection is also closely tied to dispositions in that teachers (in-service and pre-service alike) must want to act up on their reflections to change behavior (Kottkamp 1990) and that the teacher is ultimately in control as to whether or not they have the desire to reflect (Dewey 1933). Given that dispositions are an integral part of newly developed teacher standards and principles (INTASC 1998, IPSB 1998), if technology can enhance reflection, can technology also be used to model and perhaps enhance dispositions?

Dispositions of successful teachers are not as elusive and unapproachable as might be imagined. Dispositions and attitudes are not new to teacher education. Researchers and practitioners have been examining those characteristics in the literature (Robinson, Noyes & Chandler 1989; Brookhart & Freeman 1992; Pajares 1992). The difficult question for teacher education programs is how to make these dispositions real and demonstrable to preservice teachers. Davis-Blake and Pfeffer (1989) describe the dispositional approach as one that examines those stable traits that influence our affective and behavioral actions. Holland (1985) took this argument even further by saying that these stable traits or personality types impact vocational choices, satisfaction and success. Unfortunately, this position then assumes that a person cannot change their dispositions, or can't be taught a different dispositional stance. This research would indicate to teacher education programs that successful teachers and candidates could be detected by some pre-measures. Research supporting this assumption has been done as a predictor of success for urban teachers (Haberman 1993). A number of theories contrast this notion of stability and suggest that group climate, social influence and social networking can impact attitudes and behaviors, and in turn, possibly dispositions (Festinger 1954; Deustsch & Gerard 1955; Slancik & Pfeffer 1978; Pfeffer 1983). It is therefore a possibility that the dispositions outlined in the various standards are dispositions that could be "taught" to students. Alternatively, at least students might be able to become more aware of and able to adopt appropriate dispositions by being in situations which bring them into social contact with teachers exhibiting appropriate dispositions.

Project Description

This paper describes a pilot project that brought together three teachers from different parts of the country with sophomore teacher education students through an electronic discussion group in the form of a moderated listserv. A moderated listserv means that all messages are first sent through a moderator (in this case the course instructors) who determines the relevance of the message to the topic, or possible redundancy of the message. Therefore, the moderator may choose to not post a message that has little to do with the topic or is in questionable taste. The moderator may also choose to combine a number of messages that pertain to the same topic and thereby reduce email traffic flow. The role of the moderator is not to determine "worthiness" of the message except in those instances where a message is blatantly in poor taste or irrelevant to the topic.

Each teacher spent two weeks online, using email, answering the questions of teacher education students. The expected outcome was much like what has been discovered by the authors exemplified above: teachers and teacher education students alike would grow in their appreciation and understanding of the instructional uses of technology, and teacher education students would grow in their knowledge about what practicing teachers do. These outcomes did take place. However, what was more powerful and far more unexpected was the transmission from teacher to teacher education student of the dispositional stance of a successful teacher, and the display of open, honest, public reflection on teaching.

The Conversations

The electronic discussion group begun much as would be expected. Three teachers were used and each teacher was online with the students for three weeks. Teachers submitted an opening statement to the students about who they were, where they worked, how long they had been teaching, etc. Then the discussion group was opened for questions and answers. The first several days, the discussion was tentative and general. Questions and responses focussed largely on issues that students were also learning about in class. One such question focussed on interdisciplinary teaching and elicited the following response:

"I've not done a lot of integrated teaching because I haven't had my own classroom for awhile. But these are my observations: 1) Everyone has to be philosophically on board if a team is going to do it, I don't mean that everyone has to accept the concept without reservation, but they have to be willing to give time and energy. 2) The content teachers must know what the major concepts that the kids need to master are in their curriculum. You might be surprised how many teachers can't identify the BIG IDEAS in their curriculums because they rely on textbooks. Once the major concepts or big ideas are in mind, then the teachers have a framework to keep in mind when planning. 3) It's easy to forget when planning an interdisciplinary unit what skills and types of thinking the kids' needs to have in order to complete projects and assignments. For example, sometimes we ask kids to compare and contrast without making sure that they know what the words mean or whether they have strategies for comparing and contrasting." She continues:

"At my school, we are now asking ourselves three questions when we plan: 1. What's the content (e.g. concepts, big ideas, etc.--what do the kids need to understand) 2. What skills and processes do the kids need (what do the kids need to be able to do--narrow down a topic, use a variety of resources, etc.) 3. What types of thinking do kids need to be able to do--summarizing, analyzing, etc. Once these questions are answered, we have a better picture of how to structure the unit."

Then, a little over a week into the discussions, unexpected and tragic news hit the national media in the form of the Jonesboro, Arkansas school shootings. Suddenly the students were filled with questions about safety and student searches. The teacher online at that time began exposing her feelings and her attitudes to the students, and the students came to understand that these were important qualities in a successful teacher and that they were heretofore not consciously aware of these dispositions. Within 24 hours of the shootings, the following two questions were posted:

"I was wondering if teachers are nervous for their OWN safety due to the recent outbreak of violence in schools? Has anyone in your school talked about taking extreme steps to prevent student violence? Do you think anything can be done?"

"With all of the news about students bringing weapons such as guns and knives to school, do you feel threatened as a teacher, or do you just not think about it?"

The teacher responded in an honest and open manner without any pretense:

"I do not feel threatened at school and still would wade in and break-up a fight. We have had weapons at school, and we have unstable students. But then again, I have some unstable neighbors--so I do not allow

myself to get agitated. Violence is not a daily occurrence for me--if it was I don't think I would stay. We have peer mediation and civil rights groups operating in school. They're small steps--we have a long way to go in creating a situation where each student feels he/she has an advocate here, and I think that would help keeping an escalation of violence at bay. However, it is an issue that is not going to go away."

The conversations continued in this manner for the remainder of the six-week period that the three teachers were online with the students. Conversations focussed on topics emerging from class information (e.g., teaming, interdisciplinary curriculum), experiences students had in the field (e.g., classroom disciplines, faculty meetings), and items from the news (e.g., school violence, public grieving). Some of the topics were predictable; others came from out of the blue and demonstrated the level of student concern and consideration.

Teacher Educator and Student Reflection

As might be expected form this project, the discussion group elicited some reflection. One student who did not actually ask any questions, but was apparently absorbing the information offered the following:

"I have been very interested in both the questions asked and the answers given. I know that there are a lot of things I do not know [a lot] and this has been a way for me to learn about things that I didn't even think about before!"

The public reflection of both teachers and students opened doors for this student that had been previously unconsidered. At the same time the public reflection occurred, the dispositions of those individuals on the discussion group were being modeled; the teachers were being plain about how their attitudes toward various aspects of their jobs make them successful and satisfied.

The power of the electronic discussion group also surprised the teacher education faculty, as demonstrated by the following comment:

"Questions about Jonesville that Jill got; questions about national certification to Karen; and magnet school questions that Jane fielded--all three stick in my mind. I believe, from my vantage point, that your participation, as three active and involved professionals was the major cause of this level of quality. Indeed, you elevated the level of discourse for a number of reasons: students recognized that you were a committed professional; students have, and we in the department have come to understand this much better this semester, a need to talk their concerns and questions out; the security of a non-face-to-face interchange brought about a different level of conversation; and the length and tone of your responses was also a major part of this effort; the depth of detail that you went into--about everything--and the up-front honesty that framed all of the responses contributed to this."

This faculty member honestly felt that the level of student reflection he saw rose as a direct result of the discussions. Additionally, the technology became an "honest" classroom tool that achieved results beyond mere utilization, rather, the technology furthered the instructional goals of the class. Finally, his students grew to understand the importance and relevance of reflection and dispositions to the teaching profession.

Next Steps

This pilot project was a success from the standpoint of the teacher educators, the teachers, and the students. Funding obtained through internal, university grant sources allowed the teachers to receive a modest stipend for the time they spent online. The success of the pilot, the interest of faculty, teachers and students made the question arise as to whether or not a similar project could play a bigger role in teacher education. In other words, could more students participate, as well as more teachers?

During the Spring of 1998, a grant was written to obtain funding from the Educate Indiana Preservice Grant Program (Goals 2000) to develop a series of statewide electronic discussion groups. Starting in the Spring of 1999, 32 teachers from around the state, representing different grade levels and disciplines, will be online with teacher education students from all over Indiana. Three different listservs will be in operation, dealing with three different sets of teacher performance standards. As data is gathered from faculty, teachers and students, it will be interesting to discover if other elements emerge beyond the reflection and modeled dispositions. Through the experience gained with the project described here, it is fairly apparent that the results will extend beyond mere technology integration. Pellegrino and Altman

(1997) provided a challenge to teacher educators to find ways to allow the technology to be a tool that delivers unique and higher-levels of learning and teacher development. This project demonstrates that it is possible, and that such a situation might occur if it's allowed to develop.

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Essential Web Searching Skills for Preservice Teachers

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Abstract: The ability to locate, retrieve and evaluate information resources from the World Wide Web is rapidly becoming one of the foundational skills for information literacy. This paper presents a framework for introducing these skills to preservice teachers. Key concepts presented include differences between databases such as online library catalogs or ERIC and the web, keyword searching using Boolean logic, effective use of search engines, directories, and metasearch engines, frameworks for evaluating web-based information, and the location and use of pathfinder pages.

Introduction

In a recent editorial discussing "The State of the Net," Dr. Sylvia Charp (1998) made the following observation: "With all of the enthusiasm on the use of the Internet for teaching and learning, some concerns must not be overlooked. One of the most often repeated complaints is that students are not taught how to locate or access the required information." (p. 4) Perhaps students are not taught location skills because their teachers haven't had the opportunity to learn these skills themselves. In informal conversations with preservice teachers, many express great confidence in their ability to locate and retrieve information from the web. Yet, when presented with a relatively simple task such as finding lesson plans for elementary school science or social studies, these formerly confidant students are unable to locate *any* relevant resources. This paper presents a sequence of skills and concepts used to introduce basic web searching skills to preservice teachers.

Introducing web searching to preservice teacher educators begins with a discussion of hyperlinks, contrasting the traditional linear organization of information in books with the hyperlinked, webbed nature of information on the World Wide Web. Using Netscape or Internet Explorer, the concept of a browser is introduced next, emphasizing navigation and organization tools (such as the Go Menu, History, and Bookmarks or Favorites). *The Official Netscape Guide to Internet Research* (Calishain & Nystrom, 1998) provides a very helpful overview of Netscape's capabilities.

Our experience indicates that students often have a very naïve view of the amount of information on the web, and they are frequently confused about the characteristics of online indexes and databases versus information found on web pages. To help students understand the difference between searching in a controlled environment (like an online library catalog or the ERIC database) and web searching, students are introduced to the concept of searching with controlled vocabulary versus keyword searching (Basch, 1998). This naturally leads to a discussion of the power of searching using Boolean logic with keywords, which is demonstrated with Venn diagrams. Students are also presented with information about other power searching techniques such as the use of truncation and wild cards. Students learn how to broaden and limit their searches using these techniques. Barrett (1997) provides a table listing many of these techniques, and also goes on to discuss the

advantages and disadvantages of beginning with a general search or a specific search. Barrett stresses the importance of persistence in the search process, which can easily be modeled for students as sample searches are performed in class. The Eisenhower National Clearinghouse for Mathematics and Science Education (1998) presents much of this information in a clear and sequential web tutorial.

Searching Tools

The majority of this sequence of instruction centers on the use of web searching tools. These tools can be grouped into three categories: directories, search engines, and metasearch tools. Directories, such as Yahoo! <http://www.yahoo.com> or LookSmart <http://www.looksmart.com>, are the most library like search tools. Essentially hierarchical lists of subject categories, directories can be searched by category, title or name. Search engines such as AltaVista <http://www.altavista.com>, InfoSeek <http://www.infoseek.com>, or Ask Jeeves! <http://www.askjeeves.com> use spiders or bots to build a database of web pages, which the search engine then uses to conduct the actual search. Keyword searching, fundamental to all of these search engines, is stressed, however students are also introduced to advanced searching techniques available with different search engines. Finally, students are acquainted with metasearch tools, such as Metacrawler <http://www.metacrawler.com> and DogPile <http://www.dogpile.com>, some of the newest and most powerful search tools available today. (Abilock, 1997; Find it on the web, 1998) These power tools use several different directories and search engines simultaneously and provide the searcher with the intersection of the search sets. Through a demonstration, students are shown how the same search yields very different results with each search resource. Especially revealing are the different results from the different search engines that would appear to return identical sites. This leads to a discussion of the concept of relevance ranking, emphasizing that only the end user of the information can truly determine the relevance of any item retrieved. Additionally, students begin to become aware of the importance of matching the kind of information sought with the appropriate search tool. Students are provided with suggestions on how to make good matches.

The importance of evaluation is stressed throughout the instruction. All educators need to realize that

- all information is not available for free from the web,
- the information that is available can be hard to find,
- once located it can be difficult to determine the quality of the information,
- and even after the information has been located, it may not be there when you try to find it again.

Many authors (Abilock, 1997;Ackerman, 1997; Basch, 1998; Evaluating web resources, 1998; Rettig, 1996) have outlined key features to examine in evaluating the quality of information on the web. Ackerman (1997) provides several tips for locating information about the authors of web pages, including visiting the home page of the institution the author is affiliated with and searching newsgroups for additional information about the author. Abilock (1997) also suggests the use of DejaNews (http://www.dejanews.com) to locate the information about web authors.

Pathfinder Pages

While learning how to search the web is important, it is also important for students to realize that they should make use of resources compiled and maintained by others. At this point, students are often overwhelmed with the search tools and techniques available on the web, so an alternative method of information access is presented: the use of pathfinder pages. Pathfinder pages are lists of links on topics that are collected and maintained by someone who has both interest and expertise in an area. Basch (1998) refers to these as "guru pages" (p. 85), and likens guru pages to very specialized subject catalogs. Basch compares finding a guru page to "striking gold" (p. 85) and suggests bookmarking and using these pages frequently as part of effective searching. Kathy Schrock's Guide for Educators <http://www.capecod.net/schrockguide/> and David Levin's Learning@Web.Sites <http://www.ecnet.net/users/gdlevin/home.html> are both examples of general education pathfinder sites: lots of links to many different curriculum areas that are well maintained by conscientious educators. Once students realize the power of pathfinder pages they are encouraged to locate a pathfinder that "works" for them.

This scope and sequence of web searching concepts and skills, when followed by guided and independent practice, has proven to be an effective way to quickly improve the searching skills of preservice

teachers. While we present these concepts in a preservice technology use in education survey course, they could easily be adapted to any content area. Activities that allow students to practice their new and improved searching skills can be developed to match virtually any instructional objective. Once students have the skills and strategies they need to search the web effectively, they are usually eager to apply these skills to locate relevant information.

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Facilitating Critical Reflection About Field Experiences on E-Mail: Emancipatory Teaching in Cyberspace

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Abstract: This paper reports findings in a study of an e-mail discussion activity in an undergraduate methods course. Critical interpretative methods were used to examine levels of reflection in student e-mail discussions and the degree of support for critical reflection offered in the e-mail activity. Findings suggest that the e-mail activity promoted some reflection among the participants and that as the discussion developed, joint interpretations of field experiences by the participants increased; but critical reflection was rare. In light of the findings, suggestions for increased structural supports for critical reflection are offered.

There has been a move in recent years to use telecommunication networks and electronic mail in teacher education courses, especially in conjunction with field experiences (Blanton, Moorman, & Trathan, 1998; Hoover, 1994; Schlagal, Trathen & Blanton, 1996; Thomas, Clift & Sugimoto, 1996; Wizer & Beck, 1996; Yan, Anderson & Nelson, 1994). Although there have been considerable description and argument about how such electronic dialogue can enhance student teacher learning, there has been little systematic study of precisely how to structure the e-mail activity to achieve particular learning outcomes. And yet several studies have suggested that the design of the e-mail assignment may be critical (Harrington & Hathaway, 1994; Schlagal, Trathen & Blanton 1996; Thomas, Clift & Sugimoto, 1996).

In this paper I report on a study of my use of electronic mail as an activity to foster critical reflection on field experiences for preservice teachers. My studies are grounded in critical pedagogy in teacher education (Harrington, Quinn-Leering & Hodson, 1996; Hatton & Smith, 1995; Liston & Zeichner, 1987; Scering, 1997; Smyth, 1992) and social constructivist theory (Blanton, Moorman & Trathen, 1998; Rogoff, 1990; Wertsch, 1985). Critical pedagogy in teacher education focuses on the teacher's role as facilitator of questioning and analyzing taken-for-granted assumptions about the status quo from multiple perspectives that include social, political and ethical frameworks. Teachers are viewed as emancipators and agents of change in schools. To take on such roles, teachers need to look beyond their own personal and subjective ways of looking at educational situations to develop skills of critical analysis and moral decision-making. Social constructivists maintain that learning is negotiated within socio-cultural contexts. Through guided support and activities within a social context, learners are scaffolded from their present and more egocentric ways of knowing to more complex ways of understanding.

Context and Method of Study

I teach at a large private university where the majority of teacher education students are young white females who do much of their field work and student teaching in a large urban school district. For most, experiences in these urban schools are their first in a multicultural context. In the course where I conducted these studies, all 23 students were Caucasian; all but three were female; all but three were 22 years old or younger; and all but six had limited experience in multicultural contexts. The course, Teaching in the Middle School, is required for middle school teaching certification and is usually taken during the semester before student teaching. In addition to a class focus on adolescent development, middle school curriculum, and pedagogy, students do twenty hours of clinical work in a middle school where we also hold some class sessions. Located in the center of a large urban area, the school's student

population is 75% African American, 15% Hispanic, 5% Asian and 5% Caucasian. Although teachers in the school vary considerably in teaching style, philosophy, and experience, for field placements I have attempted to identify teachers who enjoy teaching at the middle school level land and who enjoy engaging university students in conversation about practice.

Beginning in the third week of the spring semester of 1997, I asked students to contribute an e-mail message to the class discussion at least once every two weeks. They could write on any topic suggested by their field experiences or related class discussions and readings. The only requirements were that messages fill at least one screen and that messages reflect reading and hearing other students' messages. To study what happened in these e-mail discussions, I asked these questions: 1) To what extent are students thinking critically about their field experiences? 2) To what extent does the structure of the e-mail activity and my own pedagogy support critical inquiry on e-mail? Primary data sources were a transcript of all e-mail messages written by 23 students and me (189 pages of text) as well as written surveys about the e-mail activity completed by students at the end of the semester.

To analyze the nature of the analysis and reflection in the student e-mail messages as well as the level of support for critical reflection, I used critical interpretive methods (Lincoln & Guba, 1985) for analysis. Hatton and Smith's (1995) levels of reflective writing were used to code the student e-mail messages. Hatton and Smith distinguish "descriptive" writing where students interpret "in light of personal worries and previous experience" (p.46) from "dialogic" writing where students step back from events, weighing competing claims and exploring alternative perspectives. Only then, they argue, can reflection move into a "critical" mode where ethical criteria, based on social, political and cultural considerations are used to call into question the status quo. Two graduate students coded all messages and then negotiated coding to 100% agreement. To analyze to what extent the structure of the e-mail activity and my own pedagogy on e-mail were supporting critical inquiry, I focused my analysis on an extended discussion that emerged during the semester about the significance of cultural differences between teachers and students. I also analyzed my own e-mail messages and the written surveys completed by students. I used social constructivist learning and critical teaching principles to develop criteria for critique of my own pedagogy on e-mail as well as the structure of the e-mail assignment. Is there evidence that the e-mail discussions and my pedagogy facilitate student analysis of assumptions or beliefs about emerging problems and situations? Does my pedagogy on e-mail push students to think beyond their subjective interpretations to consider multiple perspectives? Does the activity structure of the e-mail discussions and/or my pedagogy seem to be promoting or modeling use of broader socio-political and moral frameworks to critique the status quo?

Findings

Levels of Student Reflection about Field Work

Analysis of the student e-mail writing revealed that that students engaged in extended discussions on a variety of problems and situations that offered opportunity for critical discussion and reflection. They talked about: low teacher expectations, socioeconomic and cultural gaps between teachers and students, vandalism in classrooms, school suspension and expulsion policies, social promotion of students, the uneven quality of substitute teachers, student rudeness toward teachers, lack of student interest in the curriculum, and how issues of sexual identity might be handled in the curriculum. In addition, they shared stories and problems that arose in their first teaching experiences with young adolescents. Using Hatton & Smith's (1995) framework for different types of reflective writing, I found that early in the semester about half of the students were largely at a level of "descriptive" writing; they were simply telling stories of their field experiences along with a description of their personal feelings about the experience. One student was "sad" when a girl called another girl "an ugly rag." Another student wondered how she would deal with the math class she observed where half of the students were absent due to suspensions. Another student reported her shock over two students making calls on their cell phones in the middle of class.

As students read each other's messages, they began to jointly pose alternative interpretations for what they were seeing. One student described an eighth grade class where the students seem to have no interest in what is going on and concludes: "It is too early to tell whether or not it is the lack of classroom management or if it is the students." Another student contrasted that class to a situation in an eighth grade computer class where the students are very social: "I am not sure whether this is a sign of immaturity or simply a higher interest in and curiosity for the subject matter." In reply, another student working with eighth graders suggested that their behavior can be explained "because they rule the school and bring an attitude into the classroom." Still another student argued that it's hard to separate seventh and eighth grade behavior: "I think it just may be the luck of the draw."

During the first five weeks of the semester, only four students reached what Hatton and Smith would call "dialogic reflection." One student puzzled over a half-empty algebra class due to the fact that many of the students are tutoring in a nearby grade school. She weighed the pros and cons of their absence: they need to learn math, but tutoring " helps the students' self-esteem and confidence. They think they are making a difference." Another student told the story of coming to a computer lab where students were supposed to be typing up final drafts of a one page writing assignment that they had been working on for three days. He noticed that many students were just beginning their paper and pondered a number of possible explanations: poor classroom management, low student motivation, uninteresting curriculum. Later in the semester, however, about half of the students movedinto this "dialogic reflection." Their messages demonstrated "a stepping back from the events... a "mulling about, [a] discourse with self" (Hatton & Smith, 1995, pp. 48) about alternative explanations and analyses of situations.

Only on three occasions in the semester, however, did individual students approach a level of critical reflection where they were considering events or problems "located in and influenced by ... historical and socio-political contexts" (Hatton & Smith, 1995, p. 49). For example, one student told a story about a student who was caught with drugs and expelled. The student was an honor student and this was a first offense. She questioned a school system that throws kids out when they make a mistake: "Isn't school the place where students should get a second chance? Schools are there to help kids learn from their mistakes and to help them to succeed." Another student agrees, making reference to the historically poor treatment of children by American institutions, and continues the conversation at a critical level: "Children definitely deserve second chances but many of the institutions for remediation don't provide a helpful support system for change.... What becomes of problem children? It really makes me wonder when the school system simply dismisses a 'problem' child rather than addresses the underlying issues behind the events leading to expulsion.... children need to be treated differently than hardened adult criminals.

Level of Support for Critical Reflection

The students' move to dialogic reflection in the e-mail discussion in the middle of the semester came after a series of dramatic stories : the student who asked for help in reading but who got into a gang fight and was expelled; the girl who bit part of a boy's thumb off after he bit her in the breast; the boy who was called a "wimp" by a classmate after he had gotten roughed up in the bathroom. Then one student raised the question of whether she was capable of effectively teaching children with backgrounds so different from her own and particularly whether she could effectively teach African American children. That e-mail message led to a two week debate on the subject of cultural competence in teaching. These excerpts are representative:

> *I agree that white teachers will never have the same experiences as their black students. The same goes for black teachers and their white students. Still, this issue is entirely irrelevant. Because I am white, does this mean that I can relate better to the experiences of all white students? No! For most of my life, I've lived in an affluent...suburb inhabited for the most part by white Jewish families. With this background, I don't see how my 'whiteness' would aid me in teaching poor white students in a Kentucky mining town*

or wealthy, spoiled white Hollywood students....

I know we come from different backgrounds but that does not mean that I cannot learn from them and they learn from me. I know that growing up in an all white community has made it hard for me sometimes to relate to the students in the city schools, but I know that with experience and hard work I can be a good white teacher to my Black, Korean, Chinese, Native American and Japanese students.

If a black teacher who was raised in an urban environment came into a central city school he/she would in some ways have an easier time adjusting to the environment there than I would. However, just because something is difficult does not mean it is impossible. I think that Mr. ______ (who is white) has great relationships with his students. On the other hand, there is a middle aged African American man...[who] just screams...at the students.

I realize I have a lot to learn about the environment that the children come from because their background is different from my own...However, I do not see the difference between this and trying to reach any classroom of white students. I will have to take the time to get to know each one as an individual. I believe that I can teach any child who wants to learn.

In this extended discussion students were jointly presenting multiple perspectives on the issue of cultural conflict and competence in the classroom. The discussion generated a variety of beliefs and assumptions about good teaching, culture, and student-teacher relationships. On e-mail students seemed less inhibited than in class to challenge each other's beliefs and assumptions. But the students were doing little to question or critique their own assumptions about these topics. They drew largely from their joint personal experiences to support previously held positions. Nowhere in this thread of the e-mail discussion did students draw from the variety of critical frameworks (e.g. Anyon, 1981; Delpit, 1995; Noddings, 1994) we read in class to suggest alternative ways of looking at issues or to consider issues within larger socio-political and ethical frameworks. Furthermore, in the final surveys about the e-mail discussions, only three mentioned "reflection" or the opportunity "to think more fully" as a benefit. More typically, students cited the opportunity to "hear what other students were doing in their classrooms," get advice, and realize that others were having similar experiences.

Looking at the transcript of my e-mail messages to the students, I can see that on e-mail I was less active as a critical teacher than I was in class. I did not model critical pedagogy. I did not pose critical questions which could have disrupted usual ways of thinking about teaching, learning, and the unjust ideologies and values perpetuated by schools and other societal institutions. Instead, my e-mail messages were typically about directions, assignment procedures, and reminders. Consequently, I missed opportunities to guide the student discussion to a critical level. For example, at one point two students reported on a lesson they had tried to teach on the importance of police officers. They expressed their shock that their class of predominantly African American students did not share their own value of the police. Despite my students' efforts to get their students to say something positive about the police, most refused; only the white student in the class was willing to write a positive comment and then she made sure that no one else could read her paper. Instead of remaining silent, I should have posed questions here to help students critique the incident beyond their personal frameworks: Why were student perceptions of the police so divided along racial lines? Why do some people feel alienated from the police? Would Ogbu's (1983) theory of "involuntary immigrant" or Delpit's (1995) discussion of "cultural conflict" help make sense of this situation?

Discussion

The transcript of the conversation and the student surveys suggest that the way that I structured the e-mail assignment with focus on field work experiences and freedom to select topics encouraged students to hear and voice diverse views on a variety of subjects. This exposure to multiple viewpoints and questions from

peers seemed to move many students from descriptive reporting to a higher level of "dialogic" reflection. E-mail made it possible for students to take the time to reflect on hard questions, say what they wouldn't say in class, and consider multiple ways of coping in what one student called "an unpredictable world." This study suggests, however, that to move to a consistent level of critical reflection about their field experiences, more structural supports in the e-mail activity would be needed. First of all, both the object and goal of critical reflection must be much clearer to students. Secondly, students must have a much clearer understanding that critical reflection requires using multiple perspectives, including socio-political and moral frameworks to identify and question their own beliefs and assumptions about teaching, learning, and problems in schools. Finally, students need more models of how to identify and question their assumptions and how to utilize socio-political and moral frameworks to do so.

In the future I can see that if I want to support critical reflection on e-mail, I will need to:

1) Help students identify problems and issues that emerge from their field experiences. Instead of keeping the discussions completely open-ended, I should pose critical questions for debate and ask students to utilize particular social, political, cultural and/or moral frameworks for analysis and support. For example, from the inevitable nightmare classroom management stories that often emerge in such discussions, students could be asked to evaluate their school's suspension policy from the vantage point of Noddings' (1994) ethical caring or Anyon's (1980) "hidden curriculum."
2) Clarify expectations for critical reflection. A rubric that defines precisely what students must do in their e-mail entries could be helpful.
3) Take a more active role as facilitator in the e-mail discussions. I need to model how my experience "can illuminate and enhance our understanding of academic material" (hooks, 1994, p. 21). At the same time, I need to model how class readings can inform critical interpretations of field experiences and pedagogy. This could be done on e-mail much in the way that Dillard (1996) writes journals with her students. She uses her journal entries as places where she can "re-introduce topics, dilemmas, and questions which arise in their collective journals" and "place them back into the classroom context for critical examination from students' multiple perspectives" (Dillard, 1996, p. 14).
4) Integrate the e-mail conversations with what goes on in our face-to-face meetings. One idea would be to consider the transcript of the ongoing e-mail conversation as a class text. Periodically my students or I could prepare summaries of the e-mail discussions that include selected excerpts from them. These summaries could become the basis for face-to-face class discussions.
5) Continually monitor and support the joint negotiation of meaning that goes on in these discussions. Many students need individual support on e-mail, especially students who are struggling with critical issues, students who assume leadership roles in the discussion, students who are ignored and students who are silent. I must take greater care to insure that all have equal and ample opportunity to participate and critically reflect on their experiences.

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Assisting Preservice Teachers: A Model for Online Mentoring

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Abstract: This study was designed to determine the effects of online mentoring on the professional growth and development of preservice teachers and their mentors. These web and email based interactions provided assistance and support to the preservice teaching experience and validated the importance of both effective mentoring and effective use of technology in teacher education programs. Mentors and their assigned preservice teachers reflected positive growth from this program. The implementation of this online mentoring model emphasizes the need for both practice and continued professional support of preservice teachers.

Theoretical Framework

Mentoring is the passing of advice and knowledge from a respected, experienced person to a less experienced one. Glickman, Gordon, and Ross-Gordon (1998) identify the mentoring experience as effective among alternative professional development formats. They describe the process as one in which an experienced teacher is assigned to a novice for the purpose of providing individualized, ongoing professional support. Selected criteria for the mentor should include years of experience in the school system, effective teaching performance, interpersonal skills, past commitment to the profession, flexibility, and willingness to spend time helping beginning teachers. The National Commission on Teaching and American's Future recommends that teachers continue to teach while taking on other roles that allow them to share their knowledge and promote continued skill development related to clear standards (Wise, 1996). Practice is moving toward teaching as collegial-characterized by sharing, working in teams, observing peers, and studying with colleagues. The intellectual, social, physical, and psychological challenges that preservice teachers face require the understanding, skills, and insights which may be provided by effective mentoring (Hawley, 1997).

Too often in schools, teachers are isolated from one another so that they cannot share knowledge or take responsibility for overall student learning (Wise, 1996). Teacher preparation has traditionally encouraged preservice teachers to work alone in an environment that rewards autonomy. With few exceptions, most assignments are individual efforts (Holland, Clift, Veal, Johnson & McCarthy, 1992). Mentoring programs may help teachers with the transition from their formal schooling to teaching, providing a bridge between theory and practice (Morrison, 1997). Through mentoring the preservice teacher may incorporate a more collaborative way of thinking into their professional work.

As educational leaders engage in practices that are directed toward improving teaching and learning, the use of technology must be included. Integrating technology into educational coursework for preservice teachers is important (Stuhlmann, 1998) and can become a real catalyst for change (Drzadowski, Holodick, & Scappaticci, 1998). Electronic dialogues in preservice teacher programs have provided ongoing opportunities for declarative and procedural knowledge to be discussed and examined. Communities of practice have created forums for problem solving and lessened the isolation of teachers (Greene & Zimmerman, 1996). Preservice teachers have been studied using technology for social and emotional support (Thomas, Clift, & Sugimoto, 1996) and for general exchange of ideas (Schlagel, Trathen, & Blanton, 1996).

This online mentoring program will integrate technology with mentoring preservice teachers providing valuable support in order to facilitate professional development and the community of practice. Technology can ameliorate time, distance, and isolation barriers and establish a connection between preservice teachers and their mentors. Institutions including the University of Massachusetts Lowell have set up mentoring programs using computer-based communications such as "Teacher Helping Teachers" and "Teacher Talk." Limited studies have explored the potential of this telementoring application (Agresto, 1989; Ruopp, 1993). Telementoring has been defined as the use of e-mail or computer conferencing systems to support a mentoring relationship when a face-to-face relationship would be impractical (O'Neill, Wagner, & Gomez, 1996). Reflecting, sharing, and growing together will enable all participants to establish a vital learning community via technology.

Purpose

This study was designed to determine the effects of online mentoring on the professional growth and development of preservice teachers and their mentors. These web and email based interactions provided assistance and support to the preservice teaching experience and validated the importance of both effective mentoring and effective use of technology in teacher education programs.

Methodology
Setting

The setting for this study was a rural area of western North Carolina. The preservice teachers were completing an internship prior to beginning student teaching. The doctoral students were in their second year at a local university.

Participants

The participants in this study were 1) seventeen preservice elementary teachers completing an internship followed by student teaching, 2) five doctoral students who functioned as mentors, and 3) the university supervisor of the preservice teachers.

Procedures

Each online mentor maintained a reflective journal sent to a listserv, which was used as an initial resource for the online experience. Each mentor communicated with their designated preservice teachers at least once a week through a web page consisting of two web boards and email links to specific faculty members and the mentors. The regular communication between the online mentor and the preservice teacher was in response to the preservice teachers' regular communication with their preservice teachers, the mentors responded to others when their expertise was requested. Communication between the designated mentors and the preservice teachers was shared outside of their one-on-one relationships only with the consent of the preservice teachers. Trustworthiness and authenticity were thus assured (Lincoln & Guba, 1985; Erlandson, Harris, Skipper, & Allen, 1993).

Since the researchers specified neither the main variables nor a specific research hypothesis before data collection began, the process toward the discovery was, therefore, inductive. Grounded theory procedures (Glaser & Strauss, 1967; Strauss & Corbin, 1990) which call for findings grounded in specific contexts and in real world patterns (Patton, 1990) were used to identify emergent categories from the data. Data included the listserv, web boards, and email messages. All electronic correspondence was compiled and coded. Pre and post attitude surveys about mentoring were completed and reviewed.

Results
Pre Post Surveys

Answers to the pre and post surveys about mentoring were very similar on questions of mentor definitions and programs. On the pre surveys, preservice teachers expressed the common theme of anticipation of gaining knowledge from an experienced individual. This anticipation shifted from knowledge to more practical answers such as needing help for goals, problems, advice, and even reciprocal teaching on the post surveys. Comments such as, "I will take my mentor's suggestions and comments and apply them to my classroom", "Mentoring opens your mind to other points of view in education, which is never a bad thing", and "I will definitely try to find a mentor when I begin teaching" were written on the post surveys by the majority of students. One preservice teacher wrote that the mentor seemed to be a burden and that her cooperating teacher gave better, immediate feedback. Two wrote that the mentoring program was a good idea, but emailing mentors seemed like an extra task on top of an already hectic schedule. One preservice teacher suggested that the mentors' identity should not be secret. She wanted to meet her mentor face-to-face and have a better idea of who she was receiving advice from.

Email Messages

Thirty email messages were sent to mentors from preservice teachers within a six-week period. Written interactions between mentors and preservice teachers covered many topics and ranged from positive

statements to requests for advice. Many emails reflected a perception of negativism on the part of the preservice teacher. One preservice teacher wrote, "I feel like I have been complaining to you in all of these messages but I guess I won't get my negative questions answered if I don't ask."

Email messages to mentors from preservice teachers had one of three common themes. First, there were discussions of communication. Preservice teachers observed the lack of communication from students to teachers. Teachers were speaking to students but there was a question of whether or not they were listening to their students. An inability on the part of the preservice teacher to express his/her opinions to the cooperating teacher was repeatedly discussed. A preservice teacher wrote, "My cooperating teacher has made it really hard for me to know what her expectations are...on Monday morning my teacher really made me feel like I was a burden to her by some of the comments she made..." A final topic in communication emerged as preservice teachers showed their inability to carry out their role of teacher outside of the traditional classroom. When preservice teachers were approached by students in settings such as the cafeteria, hall, and playground, they discussed the problems of answering questions as a teacher. A student mentioned that he thought the preservice teacher wanted gum to kiss her boyfriend. The preservice teacher was so stunned she could not respond. She wrote her mentor that she was "dumbfounded".

Second, preservice teachers expressed their concern about observing and not participating within their classrooms. As preservice teachers began critically observing and participating in their classrooms, judgements began to be made about incidences in reflections and there was a clear desire to move from observer to participant. As one preservice teacher wrote, "Like any other work, (my teacher) shows them exactly how to do the artwork. In the words of the immortal 'Anne of Green Gables', she doesn't leave any scope for imagination. I do not agree with this." The preservice teacher reflects the desire to move into the participant role by asking her mentor, "How can I encourage the students to be creative without undermining my teacher's authority?" Some preservice teachers revealed a hesitation to move from observer to participant. After learning that her cooperating teacher would be absent all week, she wrote, "I'm basically in charge and I have to teach all week. I'm looking forward to this but of course I'm scared to death. The only real teaching I've done in class thus far has been on an individual basis."

The last theme was one of conflict of values and philosophical differences. Through all of these observations and comments regarding what the teacher is doing and their participation in that activity, they critically question their core beliefs and philosophical underpinnings. Questioning which leads to reinforcement of core beliefs is evident in the following email message. "I have had five children in two weeks who have had to sit on their towels on the floor for punishment, not allowed to move for more than two hours. I felt so bad for them. If the rest of the class is in the adjoining classroom for activity, my teacher wants to be in that classroom as well. She yells for the naughty to come to that room, and generally makes an embarrassing scene for the wiggles in front of two classes. I hate that. I don't believe in non-constructive reinforcement. Many of the reflections showed the reinforcement of the core beliefs held by these preservice teachers. However, an equal number of reflections indicate a wavering of core beliefs. The following email message illustrates the self doubting of beliefs that many of these preservice teachers are experiencing. "I want to know how you feel about this situation. Am I overreacting with the 'student teacher thinks the teacher is the bad guy' syndrome or am I seeing something that could be a problem?"

Based on the data gathered from the emails and the data gleaned from the pre and post surveys, mentoring was a positive experience for most of the preservice teachers. It appears to have provided a forum where preservice teacher actively reflected upon their experiences and their reactions to these experiences. Most found the experience moved from the abstract view where mentors should provide great knowledge to the more applicable use of mentors to provide practical support regarding pedagogy, discipline, communication skills, encouragement and support. All participants felt a degree of satisfaction from the mentoring program.

Implications for Further Research and Study

This online mentoring program provides a multitude of opportunities for the professional growth and development of preservice teachers and persons involved in educational leadership alike and has implications for both that go far beyond the scope of this particular study. The emergent categories include:

the various divergent and integrated uses of technology, the importance of the reciprocal nature of the mentor/mentee relationships, and the breaking through of the traditional boundaries that exist between preservice teachers and educational leaders.

With the protected anonymity and the easy access through Web-board and subsequent email communications, the students engaged in regular discourse with their mentors which enabled networking among all participants thereby reducing isolation and increasing academic support. The structured dialogue that was designed for the online discourse provided a vehicle for honest and open inquiry and for practical problem amelioration. This practice lends itself to efficiently addressing the issues and the concerns confronting the novice practitioner. In addition to providing a means for preservice teachers to access additional support and assistance beyond the domain of their classroom environment, the absence of judgement and critique and subsequent consequences allowed for a freedom of exchange that may not have otherwise existed. The combination of these facets suggests that online mentoring can offer unique opportunities not otherwise available to preservice teachers and their online mentors.

The reciprocal nature of the mentor/mentee relationship experienced on-line provided the opportunity for professional development for all participants .This unique experience promotes collegial respect, accountability, responsibility, and support, insuring the nurturing and continued development of educators and educational leaders. The emergent communication themes and the types of issues addressed in this project indicate a need for further investigation into possible uses of electronic dialogue.

Dismantling traditional barriers that divide preservice teachers, regular faculty, administrators, and other educational leaders is a formidable obstacle. However, this project proves that this goal is feasible. The expanded community of practice that is nurtured as a result of trustworthiness and authenticity reaches beyond the theoretical into the practical applications of support and professional growth for both the mentor and mentee.

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TELECOMMUNICATIONS – SYSTEMS & SERVICE

The Freeware Solution: Running an EdTech Intranet/Internet Web Server for Free

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Abstract: If you feel cost is a factor that keeps you from setting up your own internet/intranet web server, there are many free software programs for the Macintosh to allow you to start with little or no money. This paper will discuss uses for, gives names and web address, and describe these freeware tools for web serving, conferencing, Ftp, e-mail, form processing, web statistics, and listservs. Also a large number of sites with free resources for webmasters will be given.

Introduction

Do you really need a web server? The answer is yes! I decided about two years ago that a web server was essential for our Educational Technology lab. With a web server you can set up an internet/intranet web site which can:

•Disseminate information about the lab and classes- We post hours, scheduled closings, systems available, new education web sites, syllabus, and assignments.

•Provide instructional guides - Guides can cover ways to search the web, lesson plans, and other general or technological information.

•Create online assignments - Many of our assignments are on the web site, which uses forms to collect the information, and we have virtually eliminated paper.

•Enhance web instruction - I teach several courses in web page design and by having our own server I can show students how to upload pages, give practice in maintaining a web site, and setting up a server.

So maybe I've convinced you that you need a web site, but if your department is like mine, we are on a very tight budget. Every day we have to make choices about the technology we can afford and which is essential. Do you have to give up your goal of a low cost web server? Not if you use free software! This article will describe a web server set up for the Educational Technology lab using almost all free software.

The Freeware Solution

Freeware, software that is either in the public domain or offered free by the authors, is the low cost solution to setting up a server. All of the software, with several very low-cost exceptions, is free and requires only an e-mail or postcard to let the author know you are using the program. I am currently using an old Macintosh Performa 6300 running almost all freeware to host about 25 web sites as well as the Educational Technology web site. We have received over 1,000 hits per day (the EdTech web pages alone receive about 10,000 hits per semester) and have had no server problems except occasionally losing power. In addition to a web server I have also set up a mail server to handle the labs assignments.

Several notes before we begin. All of the software described in the article is for the Macintosh platform. I'm sure with a little bit of searching you can probably find the equivalent programs for the windows platform. I would suggest however, to find an old Macintosh which you may have on campus or in your department and put it to good use.

Second, at the time that this article was written all version numbers and web address were correct but as you know in the web world everything is subject to change. A good place to check for the latest

versions is at VersionTracker <http://www.versiontracker.com>. I would now like to discuss what is available as freeware for web servers, e-mail servers, forms, listservs, and forums or conferences.

Web Server software

To serve web pages as well as pdf, jpgs, and binhexed files, there are four very good professional options for free. The four are *Quid Pro Quo, Apple Personal Web Sharing, Microsoft Personal Web Server*, and *Net Presenz.*

Quid Pro Quo 2.1.2 <http://www.socialeng.com/html/download.html> is a scaled down no-frills version of their commercial product. This free version however works great for me and has been trouble free for over 1 year. It like the other supports plugins and CGI's written for the Starnine web server. Overall the best and most powerful choice to work with the other programs I'll describe later.

Apple Personal Web Sharing (comes free with System 8.0 and above) is a good server if you don't have a lot of web page or hits and can run in the background if you don't want to dedicate a computer just to serving web pages.

Microsoft Personal Web Server <http://www.microsoft.com/mac/ie/> is part of the full download of Internet Explorer 4.01. This used to be a commercial product before Microsoft bought it to include free with IE. Has an excellent online help files included.

Net Presenz 4.1 <http://www.stairways.com/netpresenz/> serves web page as well as being an ftp and gopher server. Very simple and straightforward but not as many features as the other server software. The software is shareware and costs $10.

Forms processing

There are two main ways forms can be handled, as either e-mail or database. As an e-mail, the form information is turned into an e-mail and delivered to the selected person. As a database, the info from the form is placed into a database set up by the webmaster which can be accessed or searched by other users. Good for linking forms to software database, student information or other collected information.

In our lab we use the e-mail version to turn assignments forms into e-mail. I have set up forms for written assignments, CD-ROM reviews, Web site reviews, software lists, and signups for workshops.

Forms.acgi <http://www.fmci.net/help/form.html> is easy to set up and use and sends form information from the fields you create on a web page to whatever e-mail address you specify.

Lassolite 1.2.3 <ftp://ftp.blueworld.com/Unsupported/LassoLite/> is free version of the commercial product Lasso which works with older versions of FileMaker Pro 3.

FileMaker Pro 4.xx <http://www.Filemaker.com> now has web database publishing features built in so webmasters can build forms to work with the database without any additional add-ons.

E-mail servers

E-mail servers allow you to set up your own e-mail system independent of the university you are located. I found this to be needed because many of the e-mails from the forms were taking several hours to make it to the e-mail address of the lab assistants. With my own e-mail server, the information is received immediately and reliably. More importantly, you set up listservs which will be discussed in the next section.

Eudora Internet Mail Server 1.3.1 <http://www.eudora.com/free/servers.html> was formerly Apple Internet Mail Server (AIMS). This is the free version of the Eudora mail server and easy to set up and use and supports all commons mail formats. I have used this software and received about 5,000 messages without any problems. A quick tutorial called "Instructions for setting up EIMS in about 5 minutes" is at: <http://web66.coled.umn.edu/Cookbook/Mailshare/Mailshare.html>

Stalker Internet Mail Server 1.7 <http://www.stalker.com/SIMS/> is another free e-mail server which works extremely well. This program is updated more frequently than EIMS and is the free version of a more heavy duty commercial product.

Listservs

Listservs can allow you to set up discussion groups using the E-mail servers given above. As webmaster you can set up a listserv and users need only send a subscribe message to be part of the listserv. When messages are sent to the listserv, all users, which have signed up also, receive the message as e-mail. Listservs could be used in a lab setting to discuss technology assignments, articles on technology or assigned readings, or for students looking for technical help.

AutoShare 3.0.2 <http://www.dnai.com/~meh/autoshare/> is the best listserv program in the freeware realm. The author's instructions explicitly tell you how to set up Autoshare with EIMS described above. Another tutorial on setting up AutoShare can be found at "*Providing Internet Service via the Mac OS*" <http://www.pism.com/chapt05/>

Conferencing

Conferencing or forum type software allows users to participate in discussions or forums on the web. The user may select a topic, read the responses, and then respond so that others may see their response. The user may choose to start a completely new thread or topic to discuss and in turn let others respond.

ConferWeb 2.0 <www.caup.washington.edu/software/conferweb/> is an excellent freeware that only asks you to send a post card to the author so he may list your web site. *ConferWeb* allows all of the features above as well as remote login so the webmaster can deleted threads or messages by using a password.

FTP

NetPresenz 4.1 <http://www.stairways.com/netpresenz/> is one of the few programs in this paper which is not free but its low cost of $10 is definitely worth the money. *NetPresenz* allows the webmaster to set up the server not only to serve web pages but also to be an FTP server. This is extremely useful if you have a large file or program you want someone to download because you can set up links on your web page to ftp the file to the user.

Another use for using an ftp program is the ability to upload web pages to the server. In a real life situation, most people use an ftp program to upload their web site to a remote server. Students in my web class also learn to upload to my server by using any ftp program such as Fetch, Anarchie, or Cuteftp. The webmaster sets up a public folder by merely turning on Filesharing and designating users and passwords. *NetPresenz* uses these settings to give access to the folders for web page uploading.

Web Page Statistics

For many people, just knowing how many people visited their server is not enough. If you are in this category, there are numerous free web page statistics web sites for you to choose from. Many of these sites will keep statistics such as number of hits, from where, what time of day, and about 20 other categories. A good listing of free statistics sites can be found at <http://www.markwelch.com/bannerad/baf_counter.htm>. This site lists around 50 free web counter services. There are also web counter programs that you can run on your server, but it is usually better to use an outside server counter so your server won't be tied up keeping web page counts.

Most of the free server software programs such as *Quid Pro Quo* keep a log of all users, pages viewed, location, time, and other stats. A freeware program called *Analog 3.1* <http://www.summary.net/soft/analog.html> can take your server log files and compile a dizzying array of statistics for you. Not only does it compile the statistics it publishes them as a web page. Check out the *Analog 3.1* web site to see an example.

Other Essentials

There are two other programs that are shareware and cost around $22 but can help you keep your web server up and running with little attention. These are *Keep It Up* and *AutoBoot.* <http://www.vl-brabant.be/mac/>

AutoBoot is a control panel extension which will restart your Mac server after a system error or freeze up has occurred. The program will wait several minutes and then restart itself if no action takes place.

Keep It Up can relaunch selected applications should a freezeup or error occur. It also allows you to remotely manage the Mac server through using a web browser. Great for restarting many of the programs discussed in this paper from a remote location.

Lots of Free Resources

If you don't want to have your own server but still want some free web space check out some of the following free web page posting resources:
<http://www.evandelay.com/freeinternet/fhomepgs.htm>
<http://freebyte.com/freeservices/FreeHomepages.html>

Free information and resources for webmasters:
Free Index <http://www.Freeindex.com>
Professional Web Design <http://junior.apk.net/~jbarta/weblinks/index.html>
Mikes Web Resources <http://www.websiteresources.net/dir/>
Web Wizards <http://www.cyberhighway.net/~lzc/webwiz/>
Web Master Resources <http://www.webmaster-resources.com>

The best site for lots of free resources such as javascript, CGI's, software, guestbooks, counters, and other free resources for web servers:
Free Internet <http://www.evandelay.com/freeinternet/>

A good online book (published on the web for free) from Addison-Wesley Developers Press titled "*Providing Internet Services via the Mac OS*" can be found at:
<http://www.pism.com> A helpful article for Mac Webmasters called "*Top Twenty Tips for Macintosh Webmasters*" is at <http://mac-web-tips.clearway.com/home.html>

Final Note

All of the many links I've given in this paper can be found at my web site: <http://Edtech.ci.swt.edu/SITE/index.htm>. In addition to saving yourself a lot of tedious typing I'll also try to make sure the URL's are current.

All programs in this paper are copyrighted by their respective authors and both reserve and maintain that copyright.

Project Explorer in Cyberspace: Disseminating Professional Development Resources on the Web

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Abstract: This paper reports on the technological aspects of *Project Explorer*, a Professional Development Project that encouraged a collaborative effort among preservice teachers, inservice teachers and university faculty. It explains the procedures and processes we developed for Internet publishing of large numbers of curricular materials developed by the *Project Explorer* participants. Further, it offers suggestions to others wishing to publish curricular materials on the Internet.

Introduction

Thirty-two preservice and inservice elementary school teachers participated in *Project Explorer*, a two-week Professional Development Workshop focusing on the use of technology in mathematics and science instruction. Participants were organized into grade-level teams consisting of both preservice and inservice teachers. Six university faculty members, in conjunction with subject-area specialists, planned and implemented *Project Explorer,* which took place in an elementary school in close proximity to the university. A constructivist stance that encouraged active participation and personal knowledge generation guided the project. For a more detailed description of project, go to <http://coe.west.asu.edu/explorer/intro.html>, the *Project Explorer* Introduction The ten-day project was organized in five two-day cycles:

- Day One focused on concept development, communication about concepts among team members, and reflection in order to analyze and synthesize learning.
- Day Two focused on expanding concepts learned or developed during Day One by creating curricular materials appropriate for students at each team's grade level.

This organization - which featured active learning (Day One) and sheltered work time (Day Two) - promoted opportunities for participants to both learn new processes and concepts as well as adapt them to their particular content area and grade level. During the sheltered work time of Day Two, participants had opportunities to create curricular materials that were later published on the Internet. From the onset of the project, participants knew that the curricular materials that they developed would be placed on the *Project Explorer* website.

University faculty members modeled both teaching strategies and a variety of curricular materials for the participants. Model activities and resources were intended for the participants' consideration and modification to meet the specific learning needs of their students. Faculty-developed curricular materials were placed on the *Project Explorer* (http://coe.west.asu.edu/explorer/) website as well as distributed in paper format to participants. Participants could view the Professional Development Resources on seeds to see many different

resources developed by university faculty. Professional Development Resources were also available on shapes, flight, weather and garbology. This site also provided links to national and state standards in mathematics and science. Participants' curricular materials are available on seeds, shapes, flight, weather and garbology. adjacent to the faculty-developed curricular materials.

Our major goal in developing the *Project Explorer* website was to provide participants a venue for sharing their work with a wide audience. By using the Internet, this goal was easily realized. Our other goals included providing:

- pedagogically sound models for the workshop participants
- opportunities for sharing among participants
- opportunities for sharing among other educators throughout the country

With these goals in mind, we developed the *Project Explorer* Website, as described in the following section of the paper.

Meeting Super Science Site Criteria

When we began building our *Project Explorer* website, we hoped for wide readership. To accomplish this objective, we decided to submit our site to Science NetLinks, (http://ehrweb.aaas.org/scinetlinks/) an American Association for the Advancement of Science (AAAS) site that endorses certain sites as *Super Science Sites*. (Although our workshop focused on math and science and we chose to submit our site to *Super Science Sites*, our model of a workshop and website is appropriate in any content area or at any level of education.) As we designed and built our website, we were cognizant of the major criteria specified by AAAS in their Science NetLinks. By working to meet these criteria, we not only created a better website, but we also assured ourselves of a wider readership. Our understandings and syntheses of these criteria are summarized in the table below:

Content Criteria

- Does the site contain credible content from credible sources?
- Is the site informed by the National Science Standards and the mission of the AAAS?
- Is the site a useful resource for science educators?
- Does the site represent science as an enterprise connected to society?
- Does the site material site contribute to the development of scientific reasoning and problem solving?
- Is the site free of bias?
- Is the material appropriate for its intended audience?

Technical Quality Criteria

- Is the site easy to read with clearly labeled working links?
- Do the pages load quickly and display correctly?
- Does the site invite feedback and provide email addresses?
- Is the connection fast and reliable?

Format and Design Criteria

- Are the graphics relevant to content?
- Is the design clean and uncluttered?
- Does the site include dates of publication and current updates?
- Is the site free of errors in spelling, punctuation and grammar?
- Does the site use color and graphics creatively and attractively?

Ease of Navigation Criteria

- Does the site have a searchable index?
- Is the site well organized with easy navigation tools?
- Do consistent graphics and page structure aid in navigation?

What We Learned about Website Publishing from *Project Explorer*

Process of Collection

The primary goal of this process was to emphasize that content was more important than format. Therefore, we chose to encourage participants to use whichever technology tools were available and familiar to them as they created their curricular materials. Although this approach made the technical construction of the website difficult, the quality and quantity of materials created by the participants offset this difficulty.

Participants used *KidPix*, *MicrosoftWord*, *MicrosoftWorks* or *ClarisWorks* on both Macintosh and PC platforms to create their curricular materials. Realizing that the conversion of these documents into HTML would be a difficult process, we asked participants to save their work in more than one format. At the conclusion of the workshop, all documents were collected in a central place for conversion at a later date.

Process of Conversion

The effort to convert over 350 individual word-processed documents into HTML was under-estimated. The complexity of this task was increased by several factors including:

- multiple file formats (PC vs. Mac, *MicrosoftWord*, *MicrosoftWorks* and *ClarisWorks*);
- variety and inconsistency of file-naming conventions, fonts and styles;
- difficulty converting some graphics to a web-based format.

Overall, this aspect of our project was arduous, but ultimately enlightening. The practical implications of converting such a large group of inconsistently formatted files were not completely understood. While we made it easy for our participants to generate content, the resulting variations in formatting made the final conversion of more than 350 text and graphics files into HTML tedious and difficult. Our attempt to aid the conversion process by having participants save their work in multiple formats unfortunately just introduced further variations and headaches.

For files with few problems, the typical conversion process involved opening each file with *MicrosoftWord* or *ClarisWorks* and then saving the file in HTML format. Files with more serious problems sometimes required conversion to an intermediary format (usually Rich Text Format or plain text) before conversion to HTML.

Some graphics files had to be saved separately and others had to be re-created from scratch. *MicrosoftPaint*, *Microsoft Image Composer*, and *ThumbsPlus* applications were all used to accomplish this task.

Although participants were encouraged to use word processors with which they were familiar, they frequently organized columns of data and lists using tabs rather than tables. Neither *MicrosoftWord* nor *ClarisWorks* interprets these constructions as tables so the formatting is completely lost in the HTML conversion. This meant that columns and tables required complete reconstruction in the HTML documents.

Because files had sometimes been organized by content and sometimes by authors, the conversion process also needed to address organizing the files into more appropriate directory structures for placement on the website. Additionally, many files needed to be re-named to eliminate illegal characters or provide more descriptive and/or appropriate names.

Considerations of Type of Server

Initially the *Project Explorer* website was placed on the university web server. As we developed our site further, however, we needed enhanced capabilities in two areas: searching and interactivity. Specifically, we felt it was important to add a site searching function to make our site more usable, navigable and practical. Secondly, we wanted to customize the interactive capabilities of the site to provide users easy means of feedback. Because the university search engine could not limit its search to the *Project Explorer* site or support the desired level of interactivity, our team moved our website to the newly acquired College of Education web server.

Our Approach for the Future

It is highly recommended that future projects make strict use of templates that have undergone thorough testing. Templates should include such things as background colors, clipart, images, tables, lists, font and style choices, and other common design elements. Even if the final version of the template doesn't include all these elements, the template should be tested before use by participants. Additionally, the templates should contain site navigation tools, tables, tools that encourage interactivity and other elements that may be part of the final version of the posted page. Word processors which permit the creation of tables should be used. Finally, word processors that allow documents to be saved in HTML should be used.

Another approach to addressing this issue of consistency is the creation of online forms that participants use to post their work. The drawback here is that without a significant investment in initial programming, there would be limited capability for allowing creative expression in the use of graphics, color, and design elements.

Another significant issue is that of directory structures and file-naming conventions. Ideally, participants should have access to a file server with a pre-established directory structure in place; this would facilitate the placing of files in the appropriate locations. If easy access to a server is impractical, participants should place their files on disks and organize them in a manner consistent with the directory structure. Having consistent file naming conventions based on content or authorship will also help ease the task of organizing the hundreds of files in a project such as this. Finally, a special requirement of web publishing is that names of files and directories or folders must not contain spaces or other illegal characters.

Conclusion

The technical aspects of our website publication proved to be quite complex. We have offered what we believe to be useful suggestions to simplify and streamline this process. When future website publication is contemplated, the following issues should be considered:

- criteria for excellence as summarized above;
- the process of collection;
- the process of conversion;
- use of consistent file-naming conventions, fonts and styles;
- server type and capabilities;
- use of templates; and
- on-line posting options.

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The Design and Development of an NCATE Continuing Accreditation Web Site

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Abstract: The National Council for the Accreditation of Teacher Education (NCATE) is an accrediting body within the realm of teacher education that has become a driving force within the accreditation arena. The use of technology within this accreditation process has opened the realm of documentation dispersal towards a more workable, user-friendly focus. A primary focus at this point in time is the design and development of a documentation dispersal tool through the use of the World Wide Web. Through out the design and development process, the Web site must be carefully evaluated to ensure the usefulness and ease of navigation for the end user. These considerations are of utmost importance in light of the newly integrated technological aspects within the realm of professional education unit accreditation. NCATE is at the forefront of this push and has made great strides towards the realization of its goals.

Introduction

Professional unit accreditation is a significant event within the realm of teacher education. One organization that has taken upon itself the task of accrediting the professional units is the National Council for the Accreditation of Teacher Education (NCATE). Professional unit accreditation, also described as the schools or colleges that offer the training and real-world experience for preservice and inservice teachers towards teacher certification, is a process that is fraught with documentation. The documentation is a necessary ingredient to allow the accrediting agency the background knowledge and schema to make a knowledgeable decision concerning the professional unit's accreditation status. This documentation must be available to the team of examiners that visit the professional education unit; the sole task of this team of examiners is to decide whether or not the professional education unit displays the standards delineated to ensure either the initial accreditation or the continuing accreditation of the unit. However, the documentation has historically been offered to the accrediting agencies in paper format, which is not only significant in its size but also cumbersome in its navigational ability.

A primary focus over the past few years, especially in NCATE, is the integration of technology into not only the educational experience of preservice and inservice teachers as well as students in the school systems, but also within the accreditation process. The design and development of World Wide Web (Web) sites specifically to house the documentation necessary for the accreditation process has been recently implemented at several university institutions through out the United States of America, with various levels of success. Looking towards the future, the possibility of online accreditation may be a possibility. At this juncture we are only beginning to scratch the surface concerning the endless possibilities, but the future may hold numerous innovations that will make online accreditation a reality. Without careful consideration through out the design and development process, a Web site may become a useless entity due to the difficulty in navigating the information. The navigation of the Web site is important to the end user's ease of use. The design and development of a Web site is of utmost importance to the end user's ease of use.

Design

The design of the Web site is if primary importance to the product. Without a clearly defined structure, the Web site will slowly develop into a difficult entity that will finally become too difficult to use by the primary audience. At this point in time, the persons that will be visiting the professional education unit will not necessarily have extensive technological skills unless specifically requested by the professional education institution under consideration. However, even though the professional education unit requested technologically proficient team members, the possibility is always uncertain as to whether the team members with technological proficiency will be available. Due to this possible difficulty, the Web site must be as simplistic and navigable as possible. Although this may not be a future concern, this is a definite consideration at this juncture in the developmental process timeline and one that must be taken soberly and thoughtfully contemplated.

Interface

Interface issues are of primary concern to the developing Web site. If the interface is too difficult to intuitively navigate, the end users will be unable to locate documentation of concern, will most likely become frustrated and the Web site will remain an innovative idea but one that was left unused. However, if the interface is intuitive and one which offers direction to the end users, the option to use the Web site versus the option to scrutinize hard copy documentation will most likely lead to the Web site usage. An added benefit to the Web site usage is the ability to link similar subject area documentation together; this option would not be available to the end users if using the hard copy versions of the documentation. The strongest argument concerning the usage of the Web to present documentation to the end users is the ability of the Web to present documentation in a linked fashion, which would theoretically aid the end users in their quest for information.

Home Page

The first page of the Web site, the home page, is the starting point to the rest of the documentation site. This first page must present an introductory schema for the end users so that the end users may go directly to their specific area of importance. As is clearly articulated by NCATE, each of the Board of Examiner (BOE) team members are specifically focused upon one specific standard during the professional education unit site visit. In this way, each BOE member gains knowledge pertaining to their specified standard and can critically delineate the reasoning behind either the strengths or weakness cited in the BOE Report that is presented to NCATE. Therefore, the home page is the first interaction between BOE team members and the professional education unit and must present a simplistic yet thorough persona to the BOE team members.

Template

The template is the next point of importance to the Web site. The template is the Web page structure once the end users pass the home page. The template must not only be easy to read and the navigation structure is defined, but it also must be clearly articulated as to the information available to the end user and structured in such a way that the information is linked and apparent to the end user. If the template structure is not carefully considered before beginning the development of the Web site, the usefulness of the Web site will be lessened or lost.

One consideration that was specified during a formative Web site feedback session was the inclusion of a specified area running along the side of the Web site which offered direct links to the areas under discussion in the Web page. More succinctly, the appraiser offering feedback noted the usefulness of allowing for the text on the page to be further useful by offering a table running along side the text with links to areas within the Web site that would further present the information that the end user was reading. In this way, the information would not only be presented on the Web, but would be further linked to information of importance to the BOE team member end user.

Development

The actual hands-on development of the Web site was not necessarily time consuming; the consumption of time mainly surrounded the thought processes and planning that went into the Web site home page, Web site page template, integration of documentation and cross-referencing of information. Once the planning, discussion, further planning and further discussion was underway, the hands-on development of the Web site actually amounted to very little time. The ease of the Web site development software, Microsoft FrontPage 98 (Microsoft 1997) offered very little HyperText Markup Language (HTML) scripting needs to the developer and offered numerous instances of simplistic request implementation. Through the use of this software, the developer had more time available to plan and discuss Web site issues concerning design, interface and navigation ability.

Navigation

The navigation of the Web site was the most difficult section of the Web site development. This was due to the developer's knowledge level concerning the information to be included; although the developer was familiar with overall proceedings and information, the specifics of the information was lacking within the developer's schema and was required of other members of the professional education unit. The time requirement of others within the professional education unit was a task that was completed in a timely fashion due to the feelings of ownership and desire for the positive representation of the professional education unit on a national scale. The faculty and staff at the professional education unit are to be highly commended for their efforts through out the design and development process of the Web site.

Conclusion

The issues herein discussed are merely the beginnings of an innovative, useful concept that will prove to be an integral part of the professional education unit accreditation process in the future. The National Council for the Accreditation of Teacher Education (NCATE) is an accreditation agency who will not only remain a leader in the accrediting of professional education units but, more importantly, will remain an accreditation agency that is representative of the professional education units, their needs and desires. NCATE consists of professional educators from every single part of the educational process and represents each area of education to the strongest extent possible.

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Technology Certification for Pre-service and In-service Classroom Teachers

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Abstract: The role of technology in all aspects of life is increasing daily. Because of this cascading growth, it is increasingly becoming an essential instructional and professional tool for teachers and trainers. To meet the needs of educators and trainers, the faculty and staff in the Teachers College at the University of Nebraska developed a Web based training program to certify pre-service and in-service classroom teachers in instructional technology competence. Beginning in the fall of 1998 a "Certificate of Completion in Educational Technology" training program was begun. This certification program will verify that teachers are skilled in using technology to support their teaching and training. The design of the activities in this program is based on the standards recommended by the International Society for Technology in Education for a Foundation in Technology for ALL Teachers.

In Nebraska 96 percent of the state's larger K-12 school districts have access to the Internet, and Nebraska ranks second nationally in student-to-computer ratio with 13 students per computer. The state's Department of Education has begun to emphasize the training of teachers, and pre-service students, to use this technology in meaningful ways within their schools and classrooms. In fact, many teachers already have taken advantage of the availability of technology to support their teaching and learning, but these teachers require some method by which their computer literacy can be measured and verified. A need existed, then, for teachers and pre-service students to have access to specialized programs and role models to help them develop the competencies necessary for integrating instructional technology into their classrooms, and to receive documentation from an accredited institution that verifies they can demonstrate such competencies.

To meet the needs of educators and trainers, Teachers College formed a development team consisting of three faculty and staff from the College and two K-12 teachers from the Lincoln Public School System. This team designed a Web based training program to certify pre-service and in-service classroom teachers in instructional technology competence. Beginning in the fall of 1998 a "Certificate of Completion in Educational Technology" training program was begun. This certification program verifies that teachers are skilled in using technology to support their teaching and training. The design of the activities in this program is based on the standards recommended by the International Society for Technology in Education for a Foundation in Technology for All Teachers.

The course design contains eight modules of study and is delivered via the Internet. To qualify for the certificate, the participants must complete all the self-study modules. The following course objectives are emphasized 1) to enhance understanding of the basic communication and productivity tools in educational technology 2) to integrate basic and advanced technology productivity tools into instruction and professional

growth, and 3) to demonstrate competence in the use of computers and other technologies in research, problem solving and product development.

Guiding Design Principles

The development of the Technology Competency Certification Program was based on a number of decisions regarding the targeted audience, the focus of the content, delivery options and the performance expectations of the participants.

Audience:

- The Technology Certificate Program was designed as a learning opportunity for teachers who were currently employed in K-12 schools.
- Teachers participating in the program have access to equipment, software, and the Internet either through their school or at home. This includes the opportunity to for teachers to utilize technology in teaching and learning.
- Teacher time is limited and the training should be flexible to meet the skills and styles of participating teachers. Teachers needs could best be met if learning activities occurred on their schedule and as close to their home and classroom as possible.
- Skill levels vary widely. Some teachers may be novice users who require a structured program to assist them in the process of gaining skills. Other teachers may have considerable skills and need a means to demonstrate expertise. The program should provide resources for both types of participants
- Very basic computer skills, such as starting the computer and software and managing files, are prerequisites to participation in the program. A large number of teachers possess these skills. If teachers do not yet have these skills, an alternative program with more face-to-face contact probably would be more effective. Resources for teaching these basic skills are available from a variety of other sources including local schools.
- School administrators had voiced a need to have a program that could be used to identify the technology competencies of teachers in their district.

Content:

- The Technology Certification Program focuses on basic technology skills required off all teachers .
- The program is based on identified standards including ISTE Technology Standards for All Teachers and proposed Nebraska Technology Competencies for All Teachers.
- The program focuses on application of hardware and software tools in the classroom including productivity, classroom management, teaching and learning.
- The program focuses on instructional and administrative issues related to the use of technology.
- The program focuses on identifying and using existing resources such as manuals, Web resources, and to support learning technology. This supports continuous and independent learning in participants. Participants are also directed to local support resources when they are available.

Content Delivery:

- Activities should be self-paced and student work should be done asynchronously to provide flexibility for the varied schedules of students and instructors
- The program should be developed so that participants are aware of what is expected and where they are in completing the program.
- The program should provide resources, learning activities and assessment of participant skills. Emphasis should be on assessing application of skills in teaching and learning.
- Use of a browser for access to the program allows universal access regardless of platform and software used by the teacher or the school district.

Learning /Mastery Activities:

- The Technology Skills Certificate Program provides a structure set of learning activities as the primary focus of the training. Less structured resources are made available to participants to assist in completing the activities.

- Project-based learning activities have value and application to the student beyond the requirements of this course (i.e., students' projects will be classroom-ready and will meet their own, individual classroom needs).
- Project-based learning activities allow more in depth evaluation of students application of technology skills in the classroom.
- Students should utilize productivity and learning software that they have available in the school to demonstrate proficiency
- Students enrolled for the course should be encouraged to become self-directing, self-learning technology users (e.g., students will be directed toward preexisting resources, especially those that are local, for skills training and software/hardware support)
- Participants are viewed as professionals who are responsible for completing work independently. They are encouraged to utilize resources to gain knowledge necessary to complete the activities.
- Students should receive prompt and quality feedback on their work from a qualified instructor. This requires that an instructor reads and evaluates projects
- Instructors are available to support students in the process of completing learning activities.

Course Content, Activities, and Delivery

The home page created for the program contains separate links for information about the course and using the Web site, as well as a links to an online forum and general resources students may find helpful. The link to the modules themselves, however, is password-protected, and students must use a login and password that is sent to them after enrolling for the course.

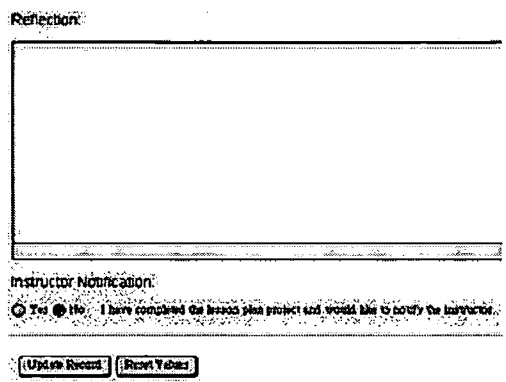
There are eight modules students must complete for a grade in the course:

- Basic Computer Operations and Communication Tools
- Basic Productivity Tools
- Integrating Basic Productivity Tools in Instruction
- Advanced Productivity Tools
- Integrating Advanced Productivity Tools in Instruction
- Application of Telecommunication Tools in Teaching
- Social, Ethical and Human Issues
- Technology for Professional Growth

Each module is consistent in design, with links to a standard set of module elements. These elements include information about the purpose and goal of the module, requirements and prerequisites, the mastery project and activities required, and resources useful for completing that specific module.

The mastery project is the heart of each module and is tied to specific computer competency standards identified in the Nebraska Standards on Instructional Technology and in the ISTE Standards. By successfully completing the project, students demonstrate they are competent in these standards. The mastery projects require students to use a variety of instructional technology tools to create multimedia presentations, thematic multimedia projects, and Web pages to produce materials that support teaching, learning, and the school organization. For example, Module 3 asks students to develop a detailed lesson plan that incorporates instructional technology, and Module 7 requires students to develop a set of technology-use guidelines for their school.

Students send their completed work to the instructor in one of three ways: taking a quiz online, submitting text online, and uploading a file through the Web page. For example, Module 3 requires student's to write a reflection piece that describes the rationale for designing the lesson as he or she did. As seen in the example below, students send the reflection to the instructor by clicking the Update button that follows the text field. Students also have the option to send notification to the instructor that their work is ready for evaluation.

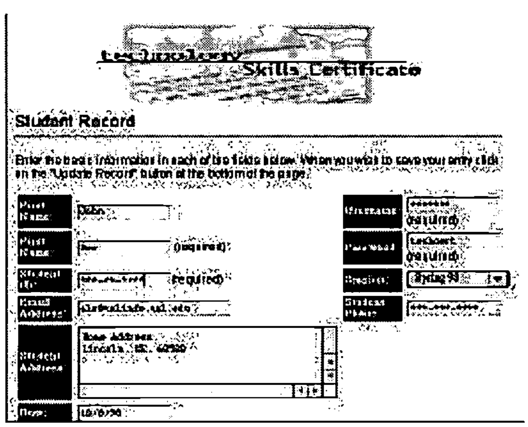


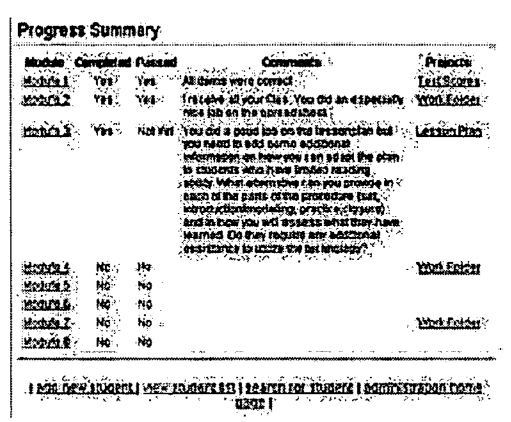
Projects created using software programs (e.g., Microsoft PowerPoint) are submitted by uploading them to student folders on the Web server. The student creates the project on his or her hard drive and, when ready, uploads the project by clicking an upload button located on the Web page. When the student clicks on the upload button, a dialog window opens so they may locate and select the appropriate file.

Administering the Course—Evaluation and Communication

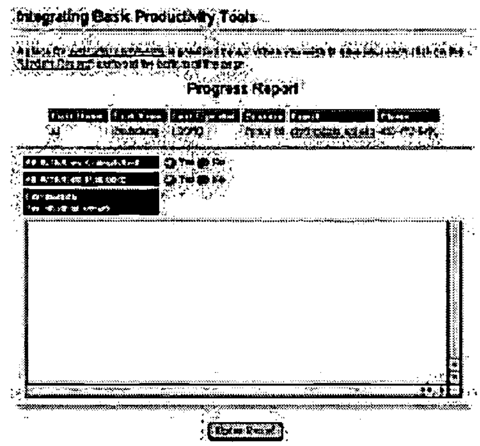
Instructional management is a key issue in establishing an online training and certification program. The development team was challenged to create a Web site that would allow students to effectively and privately communicate their knowledge and skills to the instructor, store and organize student work so that it would be easily accessible to both instructor and student, and allow the instructor to provide feedback and track student progress. These goals were achieved within a single, secure Web page generated for each student by the instructor. Within this single Web page, the instructor retrieves and evaluates student work, and the student can verify that work has been received and can read evaluations from the instructor.

The instructor has access to an administrator's Web page that is password protected. This page allows the instructor to create student records, access student work, and send comments to each student. At the beginning of the semester, the instructor creates new files for each student enrolled in the course. Each student record, an example of which is shown below, includes administrative information (e.g., student's name, address, and password), as well as a Progress Summary.





The evaluation process begins when the instructor clicks on the Projects links in the student's record to retrieve files uploaded by the student and written projects stored in the database. Each Project link opens a new page with links to the student's work. After evaluating the project, the instructor clicks on the Module links to input comments and progress information, as shown below.



The student can access a similar page to see if his or her work has been received, whether or not the work has been accepted, and any comments on the work from the instructor. Additionally, the student has access to the Projects links for easy reference to the work he or she created. In this way students can verify if their projects were uploaded correctly, and they can more quickly relate the instructor's comments to their work.

Implementation and the Future

The project has been successfully field tested and implemented. In the spring of 1998, a group of five Lincoln Public School teachers completed the course and provided valuable feedback. Specifically, this test group identified design and mechanical problems within the Web site used for the course. The test group was also instrumental in establishing clear and specific guidelines and expectations for each module.

The course was offered for the first time to 20 students in the fall of 1998. This first offering has been successful, but not without challenges. For example, it has become clear that the course should include a few, basic prerequisites (e.g., familiarity with a standard software suite). Evaluation of this initial offering of the course will be completed by summer 1999 using both pre- and post-surveys.

In future this course will be offered, with modifications, to pre-service students in Teachers College as part of the undergraduate technology requirements. The modules will be modified for students who do not have classroom experience, but the activities and projects will encourage students to model the use of instructional technology as they use it to support their own learning. Additionally, by requiring undergraduate students to complete this course, Teachers College will be able to certify to prospective employers that each graduating student has demonstrated competency in all areas of the ISTE and Nebraska technology standards.

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Creating Internet Based Learning Environments

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Abstract: This paper presents a formulation for creating educationally sound Internet based learning environments. The mere use of the Internet does not necessarily add educational value. Rather careful attention to the design of learning environments is essential, regardless of the technology used. Suggestions are offered for designing Internet based learning environments based on well researched and widely accepted "best practices" for education. These suggestions show how email, chat rooms, web pages, discussion forums and listservs can be used to create educationally rich learning environments.

Introduction

The Internet offers considerable potential for expanding educational opportunity, and educators have been quick in seizing this opportunity. Faculty put syllabi on the Web; traditional courses use links to websites as learning resources; students communicate with students at other schools by email; students use the Web as a research tool; teachers share lesson plans through websites; students and teachers conduct discussions over the Internet; schools offer classes through the Internet; universities offer degree programs over the Internet. Many use the Internet as a tack-on to traditional courses while others are using the Internet as an alternative delivery means.

Regardless of how the Internet is used in education, considerable attention must be placed on ensuring that the use is educationally sound. Simply creating a website for a course, putting lesson plans online, having students use email, or starting a discussion forum does not guarantee education will be enhanced. In short there is no magic in the technology. As many studies of technology applications to instruction indicate, it is not the technology itself that improves the instruction (Clark, 1994; Russell, 1997; Gagne and Medsker, 1996). Rather it is careful attention to the design that impacts learning (Duchastel and Spahn, 1996). If the Internet is to be an effective resource for educators, then we must consider how the Internet can be used to provide educationally sound experiences (Richie and Hoffman, 1997). We must carefully craft designs for Internet use in education. In short, we must create Internet based learning environments.

Because the Internet is fairly recent, we do not have a wealth of research on Internet based learning environments. However we do have well researched and widely accepted guidelines, or "best practices", for facilitating learning, independent of the method of delivery. One such set of guidelines was developed for undergraduate education but is applicable to K-12 education as well. These guidelines are the *Seven Principles for Good Practice in Undergraduate Education* (Chickering and Gamson, 1991). When the features and capabilities of the Internet are used to implement these known good practices, the instructional experience is very likely to be effective. The remainder of this proposal will outline how these Principles for Good Practice can be used to guide the creation of Internet based learning environments.

Best Practices

An appropriate starting point for considering how to use the Internet in education is with an examination of proven *best practices* in education – the Seven Principles for Good Practice specified by Chickering and Gamson (1991). Suggestions for creating Internet based learning environments are organized around these principles. These principles are:

1. Good practice encourages student-faculty contact.
2. Good practice encourages cooperation among students.
3. Good practice encourages active learning.
4. Good practice gives prompt feedback.
5. Good practice emphasizes time on task.
6. Good practice communicates high expectations.
7. Good practice respects diverse talents and ways of learning.

These Seven Principles for Good Practice can be implemented in Internet based learning environments in several ways. The following offers suggestions for implementing each principle in an Internet based learning environment.

Principle 1. Good practice encourages student-instructor contact.
Student-instructor is essential to a high quality learning environment. This principle can be implemented through:

E-mail as a means of student-instructor interaction in web-based courses. The quality of the interaction will depend on the instructor's willingness to respond meaningfully and promptly to many e-mail messages each week.

Listservs that allow instructors to easily communicate with a group of students. In essence, this is a form of group email in which one message is sent from any member of a group to all other members. An instructor could serve as listservs moderator to facilitate relevance of the messages to the class.

Web pages to allow instructors to distribute materials to students and to support interactivity through forms, scripts, and applets. Developing interactive web pages, like developing interactive courseware, is time-consuming, technically challenging, and expensive but promotes better interactions.

Chat rooms which are similar to discussion forums, but happen in "real time". The discussion occurs immediately as students and teachers interact at the same point in time.

Desktop videoconferencing which allows students and instructors to interact over the Internet in real time seeing and hearing each other. This is a low cost form of interactive distance learning.

Principle 2. Good practice encourages cooperation among students.
Learning environments are enhanced when students work cooperatively rather than competitively. This principle can be implemented through:

Web pages could allow students to have a shared work space that might include each student's contribution to a group project, resources he or she found useful to the group project, a timeline for the project, and specific assignments. Individual students could update their work on the site for the other students to see and use.

E-mail as a means of student-student interaction in web-based courses. Students can collaborate with each other on a course assignment, such as a case study, by communicating through email. Students can also

share work products or other resources, such as reference materials, with other students by attaching them to email transmissions. This will allow students to work cooperatively on group projects.

Threaded discussion forums that provide a web-based mechanism for asynchronous group conversation based around course topics with multiple responses possible for each topic or "thread". The instructor can assign questions or discussion topics and have students post their responses in the discussion forum. Students can read and respond to classmates' postings. Because discussion forums are asynchronous, students can read and respond when they wish. This feature reduces the immediacy of the exchange but may promotes more thoughtful replies.

Chat rooms for students to interact in real time regarding some aspect of courses they are taking. Students could use chat rooms for working cooperatively on a case study, developing a group paper, creating a group presentation, discussing questions that have been posed, or most any other activity requiring group interaction.

Desktop videoconferencing which allows students to interact in real time to carry out discussions or joint planning for a project. A shared "white board" or shared screens allow all participants to view the same information for planning or critique. This could be used to create virtual work teams or study groups among students in a course.

Principle 3. Good practice encourages active learning.
When students are actively engaged in learning activities they learn more. This principle can be implemented through:

Web pages could provide exercises for students to complete or could present problems for them to resolve. This would require their active participation in construction of responses.

Hyperlinks that allow the students to control navigation through the web environment. This learner control promotes active involvement and lets learners choose what they want or need to see.

Independent learning environments so students are no longer passive listeners to instructors who function as the source of all information. Students can be actively involved in and guided through their learning by instructions on web pages. They can work independently on problem-based learning assignments. When necessary, they can contact the instructor or other students for assistance.

Principle 4. Good practice gives prompt feedback.
Providing prompt feedback to students facilitates their learning. This principle can be implemented through:

E-mail that provides students with a mechanism for asking questions and getting individual feedback. Instructors can also use email to provide students with feedback on assignments.

Listservs that allow instructors to easily communicate with a group of students and provide feedback on projects or other group activities.

Threaded discussion forums that allow any subscriber to provide feedback on any comment made in the discussion forum. Thus both the instructor and other students can contribute feedback.

Principle 5. Good practice emphasizes time on task.
When students are directly focused on and engaged with the learning task for a greater amount of time, they learn more. This principle can be implemented through:

Website with a course syllabus that provides explicit directions for students to proceed through the course. All assignments and expectations are clearly stated and available for reference at any time. This would allow students to focus their time appropriately on the learning tasks.

Flexible mastery learning that allows learners to invest the amount of time needed to learn the material. Students with high prior knowledge of the subject matter may spend less time while students with lower prior knowledge require longer to read and process the same information to complete assignments.

Email that allows students to ask for guidance at any time when they are getting off track or confused.

Hyperlinks with annotations to help students keep on task by guiding them to essential sites. Otherwise students may become distracted or diverted when following external hyperlinks.

Principle 6. Good practice communicates high expectations.
When instructors have high expectations for the students and communicate these to the students, the students learn more. This principle can be implemented through:

Website with a course syllabus that clearly states expectations of students. The roles and responsibilities of the students can be clearly communicated through information on the website. Expectations about the quality of their learning and their work can be made explicit through objectives, examples, and practice examinations.

Listservs that allow faculty to communicate expectations to students. Careful advising of students is important in Internet based courses to make sure they understand course requirements and directions for completing course assignments.

Principle 7. Good practice respects diverse talents and ways of learning.
Students have different talents and different ways of approaching learning tasks. Learning can be enhanced by taking these into account. This principle can be implemented through:

Multimedia environments that incorporate text, graphics, audio, animation, and video thus appealing to multiple senses and learning approaches. An Internet based learning environment is multimedia oriented which gives the students freedom to learn as they wish.

Independent learning environments that allow students to participate in a class when it is most convenient for them, when they have time and energy for learning. An Internet based learning environment is time and place independent which gives the students freedom to access instruction when and where they wish.

Summary

To take advantage of the educational opportunity offered by the Internet requires careful consideration of how the Internet is used in education. Appropriate use of the Internet, or any technology, in education should be based on proven educational practices. There is no magic in technology to compensate for or improve on poor educational practices. Principles for good educational practice such as the *Seven Principles for Good Practice in Undergraduate Education* (Chickering and Gamson, 1991) should form the basis for developing Internet based learning environments. This paper shows how the Internet can operationalize these best practices. By using these research-based principles, educators can create educationally rich learning environments on the Internet.

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Teaching Teachers on the 'Net: A Study of Web Use in Teacher Education Courses

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Abstract: There has been great emphasis on utilizing the Internet and the World Wide Web as a teaching tool and instructional medium in teacher education programs across the country. This paper describes the elements of web-enhancements to teacher education courses in thirty-nine classes offered at eleven colleges and universities with teacher education programs. Web enhancements from a sample of teacher education courses at the top 20 graduate schools (according to 1998 U.S. News Graduate School Rankings) were examined. Elements of sample web pages are organized into six areas, Web Syllabi, Web References and Readings, Web-based Instruction, Web-based Communication, Students' Work on the Web, and Distance Education. Conclusions on the future of web resources in teacher education are presented.

Introduction

According to the National Center for Education Statistics (NCES) March 1998 Issue Brief, approximately 78% of all public schools have some sort of access to the Internet (NCES, 1998). This report goes on to indicate that one challenge to use of the Internet in schools is time for and access to professional development by teachers and administrators. However, in 1994 only 15% of teachers had at least nine hours of training in education technology (Edwards, 1997). In a 1990 national survey, 81% of student teachers surveyed rated their undergraduate preparation in technology use as inadequate (Fratianni, Decker, & Korver-Baum, 1990). Although teacher preparation in the area of technology has evolved since the early 1990s, teacher educators continue to evaluate how they can capitalize on the features of technology to expand student understanding (Garofalo, 1998). To help teachers better utilize technology effectively as an instructional tool, teacher educators in colleges and universities must rethink their courses to provide training and hands-on experience to students (Cradler & Parish, 1995). Faculty modeling the use of technology, through integrating computers and the Internet into the curriculum, is an ideal method for preparing teachers (Thomas, Larson, Clift, & Levin, 1996).

In addition to the need to prepare future teachers to use computers and networks simply because of the influx of technology in society, teacher education institutions are also being persuaded to use technology by accrediting agencies. The National Council for Accreditation of Teacher Education (NCATE) has incorporated the need for technology into standards for teacher accreditation. For example, one standard in the area of Content Studies for Initial Teacher Preparation expects candidates to "complete a sequence of courses and/or

experiences to develop an understanding of the structure, skills, core concepts, ideas, values, facts, methods of inquiry, and uses of technology for the subjects they plan to teach" (NCATE, 1997). The International Society for Technology in Education (ISTE) and the International Technology Education Association (ITEA), two professional organizations in the area of educational technology, have devised standards for all pre-service teachers in the area of technology. Important elements of these standards include demonstrating strategies for the educational use of electronic networks, such as the Internet, interpreting knowledge about computers, and illustrating the effective use of computers in classrooms (Wetzel, 1992).

Given that the web is the most common tool used on the Internet, it is important for teacher educators to model the educational use of on-line materials. In a report developed by the North Central Regional Educational Laboratory entitled Plugging In: Choosing and Using Educational Technology, indicators for engaged learning and high technology are outlined (Jones, Valdez, Nowakowski, & Rasmussen, 1995). These indicators were designed to create a framework for using technology that complements learning. The report calls for technology-based instruction that is engaging, distributed, designed for user contributions and collaborative projects, and provide guided participation.

Classification of web-based activities range from those that allow the user to access materials and materials at any time, to those that permit synchronous (real time) communication. Berenfeld (1996) discusses a continuum of educational activities that may take place on the internet, such as "Tele-access", in which students retrieve information from remote sources, "Tele-mentoring", in which student are mentored by online experts, and "Tele-sharing" in which students collaborate and share information they have developed or discovered. In the Apple Classrooms of Tomorrow (ACOT) model, teachers' adoption and evolutionary processes with technology can be identified at the lowest level (the entry phase) which includes information distribution to the highest level (invention) where students interact in cooperative, project-based, and interdisciplinary learning activities (Apple Computer, 1995).

As teacher educators strive to develop web-based materials that are matched to accreditation standards and that create cooperative learning environments for pre-service teachers, reflection on current practices can be a valuable tool. This paper is not intended to be an exhaustive description of web-based teacher education, but a snapshot of how the web is being used in some highly regarded teacher education institutions.

Methodology

For this project, a sample of web-based course materials were examined from colleges and universities included in 1998 U.S. News Graduate School Rankings in elementary, secondary, and special education. Web pages were identified and monitored that were offered during the fall of 1997 and spring of 1998. In cases where web-based course material was not readily identifiable via the departments' main web page, institutions were contacted via phone or email to identify the Universal Resource Locator (URL, also known as web-address) of web-based courses, if any. In total, 39 web pages were identified and monitored, representing eleven colleges and universities. Courses represented in the sample included educational psychology courses, methods courses for math, science, language arts, and special education, educational technology courses, and educational leadership/educational administration courses. Courses were taught in departments, schools, and colleges of education, as well as in related departments outside education, such as human resources or instructional technology. All course instructors were contacted for permission to include their course in the project, and were all guaranteed anonymity.

The 1998 U.S. News Graduate School Rankings is based on the ratings of academic quality of 191 graduate schools that offer Ph.D. or Ed.D. degrees (Harrison, 1998). The ranking are based on four attributes; reputation, student selectivity, faculty resources, and research activity. For more information about the U.S. News ranking, visit their web site at http://www.usnews.com/usnews/edu/beyond/gradrank/gbedmeth.htm.

Results

Web pages for teacher education courses were monitored over the course of the 1997-1998 academic school year. Elements of the Web pages were identified and categorized based the amount of student interaction and communication encouraged, the degree of cooperative activities, and the resources available for instructional purposes. These general guidelines for classification were derived from other systems, such as

those used by Berenfeld (1996) and ACOT (1997). Table 1 illustrates the elements of the web pages that were identified.

Level of Web Enhancement	*Enhancements Included at this level*	*Percent of web pages that included these enhancements*
Web Syllabi	Description of course, course schedule, requirements, email to instructor	97%
Web References and Readings	Links to resources (either within the university or external sources) to support course content.	70%
Web-based Instruction	Lecture notes, detailed text-based instruction or lectures, simulations, study guides.	40%
Web-based Communication	On-line discussion groups (either links to class listserv discussion or web-based discussion and chat areas)	30%
Students work on the Web	Students' projects are submitted via Web pages, descriptions of students, students' grades posted on the Web page.	48%
Distance Education	The entire course is presented via the web page, with no or only a few "face to face" meetings	3%

Table 1: Elements of Teacher Education Web Pages

Web-Syllabi

In this first level of web-enhancements, the web page contains the course syllabus, schedule, requirements, and related assignments. All but one of the class web pages (or 97%) that were accessed for this project contained at least this information. Information on these web pages was often adjusted or updated through the course of the semester in which the class was offered, including changes in schedule or special announcements about course meeting locations.

Web references and web readings

The next level of web-enhancement used the web page to provide timely readings and research that are matched to the course content. For example, in an educational psychology course, links to readings related to topic of in-class discussion in class are presented via the class web page. Links to professional organizations, newsgroups and government agencies are common on this type of class web page. Also included at this level of web enhancement might be access to the professors' email address, office hours and location, and information about instructional support, such as teaching assistants' names and email addresses, and campus resources for tutoring. Often, these materials were updated throughout the course of the semester in which the course was offered. Approximately 70% of the web pages included these materials.

Providing instruction via web pages

At this level of web-enhancement, instruction related to course content was presented via the class web page. This included lecture outlines, detailed instructions for completing assignments, and sample projects or papers. This level of web-enhancement might also include simulations or detailed written materials relating to the course lectures, in most cases developed by the course instructor. Instructional materials where found on 40% of the web pages.

Web-based communication

On 30% of the web pages sampled, some sort of communication took place between students and the course instructor(s). This may include web-based chat areas, web-based discussions, and links to the class email (listserv) discussion group. In about half of these classes, the students' participation in this discussion was required as either a component of the attendance policy or as a separate, graded activity.

Students' work on the web

One component of approximately 48% of the course web pages was student designed materials. These may include students' web pages designed in educational technology course, students' lecture notes or review materials for tests, and sample reports and projects created by students in previous sections of the course. On four (13%) of the web pages in the sample, students' grades were available (through a password-protected secure server).

Distance Education

Two (or 3%) of the courses monitored in this project were truly "distance education" courses. In these classes, students participated in web-based discussion, used web-based readings and references, and submitted all work via the class web page or via email. In one of the course, a textbook was required, and in the other, there were six optional on-campus class meetings. When the instructor for the course with the "optional" class meetings was contacted, she indicated that approximately 70% of the students who successfully completed this course showed up at least once to these on-campus meetings.

Conclusions

Teacher educators are using the web to teach, interact with students, and create safe environments for experimentation and discovery. Of the Web pages sampled, only 30% were classes that focused primarily on technology. Courses from early childhood education to adult learning are were included in this sample, which indicates that technology has begun to infiltrate classes across the teacher education curriculum. Pre-service teachers are being given the opportunity to collaborate in virtual communities, and explore the social, ethical, and human issues of using technology as a tool to teach children.

As mentioned in the previous section of this paper, two of the courses in this sample could be labeled as "distance education" courses. In both classes, students were able to register for the course on-line, and obtain course materials, read lectures, watch simulations, and interact with fellow students all via the class Web page. Many universities and colleges are preparing to offer (or are currently offering) a variety of distance education courses to pre-service and in-service teachers, and based on the two examples represented in this sample, these on-line courses will be valuable tools in teacher training no matter the location of the student.

The Department of Education estimates that by the year 2000, 95% of all schools will have some sort of access to the Internet (NCES, 1998). As teacher educators confront the challenge of training teachers for these classrooms of tomorrow, the importance of providing appropriate models of Internet use is of great importance. There is no question that teachers in tomorrow's classrooms will use the Internet to continue their professional development well into the next century. Therefore, it is the responsibility of teacher education institutions to develop programs and courses that meet the demand for greater technically expertise, and that these program and courses be available to teachers no matter their distance from university and college campuses.

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Online Communication-Building Learning Communities

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Abstract: Children in today's society must function in many environments. The home, family, school, neighborhood, peers, and society generally shape our children for the future. Teachers, partners of this cyclical challenge, have to be prepared to help students meet the challenges of the world 2000. Teachers can learn to meet this goal by creating learning communities through technology and sound teacher preparation programs. A program that allows preservice and inservice teachers to use online communication to enhance their personal growth is the beginning of an online community. The availability of synchronous and asynchronous activity, through the use of WebBoard, is demonstrated and explained in this paper. Samples of assignments, solutions to problems teachers faced online, and ideas for future assignments will be discussed.

Introduction

Communication, defined loosely as an exchange of information, is essential to both preservice and inservice teachers. Without effective communication skills, a preservice teacher may quickly leave the profession or an inservice teacher may have the anxiety of being lost in a "vacuum". Feelings of isolation may come from being in a classroom with no one to turn to, but the students who sit before them daily. Communication with colleagues at the school, during the instructional hours, is often limited to handling and discussing problems, which may increase feelings of isolation and frustration, as educators do not have the opportunity to look at their situations from a larger perspective, and to realize that their problems are often unique – and that other educators may have found some solutions. The opening of communication channels with the outside world, often enabled through the latest technology, may help educators feel a part of the larger professional community of educators.

The Computer and Communication

Within the past twenty years the computer has become a facilitator for managing different types of communication for educators. It has literally become the bridge for educators with the community. For example, by using the Internet, both preservice and inservice teachers communicate with all kinds of businesses such as banks, retail stores, airlines, and others through email. They have learned to access numerous databases to obtain the latest weather reports, stock market information, news stories, or medical information for the classroom. The classrooms have become more student centered, collaborative, and interactive by the use of telecommunication networking. (Kellough & Kellough, 1998) The students learn new inquiry and analytical skills in stimulating environments, increasing their awareness of their role as world citizens. (Cohen, 1994) The computer and the teacher become facilitators in the classroom. Now the challenge becomes how to connect them more with fellow educators so the feeling of isolation is dismissed.

Learning and producing learners is a lifelong endeavor for a teacher. Participating in a teacher preparation program that emphasizes technological skills for the classroom and the world can help teachers enhance their

professional growth. When preservice and inservice teachers know that they can communicate freely with university instructors and each other on line, the base of the learning community broadens. Basic skills start in the university class where preservice and inservice teachers receive training using email, mailing list, and bulletin boards. Demonstrations of how to use chat rooms to review for test, to seek advice from colleagues or educator – supervisors, to discuss research, and to complete many other tasks become the objective. This kind of communication leads to self-inquiry and more knowledge of the teaching profession. A profession that produces better-prepared and knowledgeable personnel who lead their students one step further into a technological society is a definite benefit.

One University's Program

The mission of our teacher preparation program is to provide, through a collaborative commitment, relevant field-based teacher education and staff development programs that integrate research supported, innovative teaching and assessment practices with technology so that educators share a common vision of improving the learning and achievement of all students. This collaboration has resulted in partners integrating technology with the best teaching practices in a more effective manner. The placement of technology in the classrooms rather than labs and providing ongoing staff development and support in the public school has been the heart of the program. This allows for multiple levels of communication. For example, professors and preservice teachers have used email for basic communication while demonstrating their content mastery through multimedia presentations. This starts the process of moving professionals into the 21st century.

Preservice Teachers and Email

On the university campus preservice teachers use email to send their weekly journals. These reflective journals demonstrate their teaching activities and their observations of the school environment. Preservice teachers also discuss classroom problems and professors send back responses in the form of advice. A sample entry follows:

> Dr. Justice:
>
> With Halloween coming last Saturday we did a lot of activities directed at the holiday in my LIFE class. By doing these projects the students met most of their objectives including working cooperatively/sharing space and following functional commands. These were a lot of fun for the students and gave me the opportunity to observe and work with the students on new and alternative activities. We also included the regular activities and lessons that we do each week. Next week we will wrap up the six weeks by reviewing. This is the first six weeks we have done colors fully and it will be interesting to see how much retention the students will have after this period of time.
>
> **We are going on a field trip during the A.M. (9-11) on Tues., Nov. 3.
>
> Health is going pretty well. I still get a little discouraged; having such a big class sometimes presents behavior problems. I am working on disciplining and feel I have a much better idea about it now that we have discussed what causes misbehaviors and ways to address them. As far as instruction, I have had a much more student-centered teaching environment and the test grades this time were somewhat improved so I will continue to have the students be involved in the instruction like we discussed. With the six weeks wrapping up I am worried about a couple of low grades but I have discussed this with my mentor and the students involved. We are working toward having a successful six weeks for everyone.

The response of the professor:

> L___,
>
> I enjoyed both of your classes. The students in the LIFE class are doing fine. They are learning a lot. Let me know the date of the field trip.

Is next week the end of the six weeks? What is the exam schedule? How many students are not doing well? What have you done to provide assistance?
Continue to lecture less and let the students do more of the work. This takes some thinking and arranging. Make it fun and relevant! Make sure that you call on everyone in the class.
Hopefully, I can give you more advice on Monday.
See you Monday!!!!
Madeline Justice

This type of email shows the preservice teacher making thoughtful decisions in the classroom.

Preservice Teacher and the WebBoard

Additional communication was set up by the use of a WebBoard. This was to get students familiar with a different type of communication. The professor showed students how to register on the WebBoard system and how to respond to a posted assignment. On the WebBoard, six rooms were set up and three students were assigned to a room to answer a review question over a reading assignment. A sample of a posted assignment with student responses is below:

Dr. Justice's Online Office (0)
Rm 1 (5, 5 New)
Rm 2 (5, 5 New)
Rm 3 (3, 3 New)
Rm 4 (3, 3 New)
Rm 5 (5, 5 New)
Rm 6 (4, 4 New)

Classroom Management (1 of 1), Read 11 times
Conf Rm 2
From: Dr.Justice. (madeline_justice@tamu-commerce.edu)
Date: Sunday, October 11, 1998 03:31 PM

Give at least three different examples of a student wanting attention in the classroom. Discuss the many ways in which you would solve each problem. Each member in this room should give an example and solutions to the problems.

The preservice teachers' reflections after being in the chat room:

Topic: Classroom Management Reflection (1 of 1), Read 11 times
Conf: Rm 2
From: D C (______@juno.com)
Date: Monday, October 12, 1998 08:47 AM

We talked about students that seek attention in the classroom. We covered many of the methods for handling this situation. Many of the methods that we covered came from the book, and we also discussed experiences in the classroom.

The chat room was pretty fun, and it seemed like it could be a very useful tool if you could find a chat room on a topic that you needed to discuss with someone maybe to get another opinion, or maybe a place to vent frustrations.

Another sample message on the same topic follows:

Conf: Rm 6
From: L L (_____@_____.tamu-commerce.edu)
Date: Monday, October 12, 1998 08:47 AM

E M and I discussed the four goals of misbehavior in the classroom. What some examples of these might include and how it might be good to deal with them. I enjoyed the chat room because it was more like a discussion than a question-answer set-up. It was nice to talk about the question and get help and another person's viewpoint.
In the next session students were shown how to use web board to communicate with each other.

They were shown how to enter a chat room, chat about their experience in the schools, and again summarize their experience by posting a message to the professor. A sample follows:

Date: Monday, October 26, 1998 09:22 AM

This is from A I. The last couple of weeks have been great. I had some reservations
about the shift to regular history but it has been great. I enjoy the format of the American
history class and most of my classes are great. Eighth period is a little loud but I think they
are basically good students and generally bright, I think. Next week will be great. I am more confident
with my lectures and ability in front of the class.
A I

A sample chat by student teachers to the past week's experience went like this:

10/12/98 08:20

E S: Hi D___ and S____
D. C.: Hi! Everyone!
D. C.: How are your classes going?
E S: Pretty Good. Where's S____?
D. C.: I have one student that had decided to cuss a student from across the room. My response was to write a referral on her. Would you do the same? I haven't heard from S____, yet.
E S: I probably would have done the same. That way all the other students could see that this was a major offense and it would not be tolerated. E___ S____: I haven't had anything quite that severe yet. Thank goodness
E S: Hey S_____
D. C.: Friday, the same student asked if we could leave class two minutes early. I told her no, of course. She waited a few minutes, then asked again. My response was the same. Hi, S____!
D. C.: How are your students acting when Dr. Justice observes you? S____ S_____: Hello, this is S_____, copy?
D. C.: Copy.
E S: Dr. Bennett observes me. They usually act pretty well. He comes and observes one of my....

This way preservice teachers are able to get quick responses and also feel that they are not the only ones having problems. It is always an eye opening experience for the preservice teachers to talk to someone who is going through the same or different experiences. They use each other as sounding boards and get a sense of relief that helps them to grow. After this experience, a student sent the following email message to the professor from his computer at home.

Date: Sun, 25 Oct 1998 18:25:10 -0600 (CST)
From: J F S <___@___.tamu-commerce.edu>
To: Madeline_Justice@tamu-commerce.edu
Subject: Re: Welcome to Dr. Justice's WebBoard!

Dr. Justice,

I really had fun using the web board it was quite interesting. Thank you for the experience maybe in future I will the become more comfortable with the board. Thanks again!

Preservice Teachers and the Professor

Email is an excellent way of communicating, but the students and professor wanted to engage in a conversation with students from their own environment, home or the classroom. This communication was from the home. A distance of forty-eight miles was between them. Using the web board both parties (professor and student) went online. They were able to chat for an hour about what the professor had observed in the classroom. On that particular night the travel of communication was slow, but effective and beneficial. The professor talked classroom observations and the preservice asked for advice in managing several of the students. The preservice teacher took the advice and incorporated several strategies discussed in the online chat.

The Preservice Teachers Communicating with Inservice Teachers from the University

Preservice and Inservice teachers were able to communicate about online resources. Inservice teachers in graduate classes had created online resource pages, and the preservice teachers had the opportunity to visit and critique them. This provided the preservice teachers with a chance to participate in the professional educational community, as they provided feedback to veteran teachers. As students sent their comments to teachers, and the teachers responded, it helped these future teachers consider what is needed in the classroom, and maybe some strategies to accomplish this. This activity reinforced the importance of getting and giving support.

Another activity, along the same lines, required students to visit web sites of schools around the United States. Each student selected a school to visit, and then chose a faculty member to write to. The message included an introduction from the preservice teacher, and a question about an area of concern related to classroom management. This opened up the doors to broadening the perspectives of our preservice teachers about schools around the country, as well as about some possible job openings. These communication activities gave the students a chance to develop skills that will hopefully encourage them, in the future, to find other professionals in their teaching fields from whom to seek support.

Preservice Teacher s Communicating with Other Professionals Around the World

In another class preservice teachers were asked to contact other schools in and outside the United States. They were to send a letters of introduction and ask questions of concern about their classrooms. A response to the student follows:

From: Charles Campbell Secondary School <______@______.edu.au>
To: ______@koyote.com
Subject: Re: School Info
Date: Friday, November 27, 1998 12:02 AM

At 08:33 AM 11/24/98 -0600, you wrote:
>Hello.
>My name is E____ M____, and I am a recent graduate of Texas A&M University at Commerce. I
>plan to teach English on the secondary level. I would like to hear about your English Department
>and your community. I have always wanted to go to Australia, so I am extremely interested in your
>school. Thank you for your time.

Dear E____,

Thanks for your note. It is a huge task to do as you requested, and as we are at the end of our school year and into exam marking. I am unable to tell you very much. English here is very interesting, as we do a balance of activities, from classic to popular literature, and media and everyday texts, in addition to a wide variety of writing about these texts and of a more general and creative nature. Speaking and Listening tasks are also important. Students also do independent reading and writing

tasks. We have recently moved towards a national curriculum although not all states embrace the move. The aim is to establish some uniformity of curriculum and assessment levels.

I love English as we can choose our texts and tasks from a huge range of possibilities, so it is easier to interest students than it was in the days of set texts. Our school is well resourced and much better than many schools as it was recently refurbished and is a bit of a showpiece.

This school is a very diverse one, We have a large number of Italian students - now 3rd or 4th generation, and also many Asian students and some from the Middle East. It is a suburban area where most people live comfortably and have high regard for education. I am not going to be here next year, as I am moving to a school nearer my home. I will no longer have email, but if you want to contact me at all, my address is 1B Sylvia Court, Coromandel Valley, South Australia. 5051.

Will you look for a teaching exchange? I did one last year to Ontario in Canada and lived near Niagara Falls, an interesting experience! Good luck with your ambitions. Our email is off from Monday due to the upgrading of the system, so don't reply. We finish school on Dec 18th for 5 weeks and our summer vacation - I am going to New Zealand.

Conclusions

It is very important that a preservice and inservice teacher communicate with professionals in and outside of the school. If they seek advice in the area of classroom tips, then they are engaging in growth. If they are growing by the use of technology, they are able to encourage their students to do the same, and therefore become a part of the world community.

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TeleLearning Professional Development Schools (TL•PDSs): Emerging Patterns of Time Management Within and Between Sites

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Abstract: This paper is a report on the findings of an on-going research program on teachers' learning of new pedagogies supported by telelearning tools. Computer-supported learning communities that involve high school learners, preservice teachers, inservice teachers, and teacher educators are designed, and reflected upon at a number of sites and between sites (TL•PDSs). Emerging trends of effective use of online resources and tools serve as guidelines. Researchers' data points to emerging patterns of time management in communities of learners that combine face-to-face and online interaction. Three of such patterns are emphasized: 1) interacting with others before, during, and after class; 2) planning on a longer time scale; 3) evaluating participants' past and future ways to contribute effectively to one another's learning. TL•PDSs evolve as complex dynamic systems, ones likely to encourage participation in new practices of inquiry and sense-making.

This paper points to time management advances related to the effective use of online resources and tools for extending or transforming teacher professional development practices.

Networked Learning Communities in Teacher Education

Networked learning environments require professional knowledge in order to effectively use telelearning resources and tools. A key area where professional knowledge must be applied in the networked classroom is time management. For instance, time management takes new dimensions when the networked classroom opens up to other classrooms (schools and universities).

The telelearning professional development schools (TL•PDSs), which are part of the research program of the TeleLearning Network of Centres of Excellence (TL*NCE), are anchored in both school and university settings. Collaborative learning is computer-supported, and networked learning communities are exploring ways to effectively use online resources and tools (see Breuleux, Laferrière, and Bracewell, 1998). This multi-year research program is building on the works of SITE leaders such as Glenn Bull who with his team showed, ten years ago, the way to the "electronic academic village" (1989).

Computer support for collaborative learning, mainly developed by other TL*NCE researchers, are experimented with. The two main telelearning tools that support collaboration in the TL•PDSs are Virtual-U and WebCsile/Knowledge Forum. Websites (Internet) and local networks (intranets) support individuals' or teams' learning and teaching projects (TACT being the main site, Quebec City, and interconnecting with associate websites such as Studio A in Vancouver, McGill Teacher Knowledge in Montreal, and

WebCsile/Knowledge Forum at OISE/UT in Toronto). TACT is the acronym of the interactive website named *Technology for Advanced Collaboration between Teachers,* dedicated to supporting preservice teachers, the communications between themselves, and with teachers and teacher educators, and their collaborative learning projects (http://www.tact.fse.ulaval.ca).

The network that we are developing in Canada, which builds also on the Professional development school model (Holmes Group, 1990), reaches far beyond a school or a university by including among their active participants, teachers, students, undergraduates and various other experts from a number of schools, universities, and associations.

Effective Uses of Online Resources and Tools

The online materials, tools, and collaborative teaching and learning activities that are part of the TL*PDS are used in a mixed mode, that is, combined with face-to-face meetings. Collaborative teaching and learning is being practiced in a differentiated manner at each site. The development side of this R & D project aims at building teachers' declarative, procedural, and conditional knowledge with respect to the effective use of time for learning and teaching purposes, whether they are student teachers, teachers, or teacher educators. The research side aims at documenting the ways in which online resources and tools enhance the interaction of knowers with knowledge and with one another (see Harasim, 1995, the leader of the TL*NCE research program).

The contribution of our research program to the study of how telelearning technologies may be effectively used for information, communication and collaboration purposes takes an inside-out classroom perspective. The most recent documentary review conducted (Bracewell, Breuleux, Laferrière, Benoit, and Abdous, 1998; see also Grégoire, Bracewell, and Laferrière, 1996), led to the identification of models of use, trends, and research gaps on the contribution of effective uses of online resources and tools in the classroom of the elementary and secondary schools and post secondary institutions (http://www.tact.fse.ulaval.ca/ang/html/review98.html).

For the purpose of this review, online resources and tools were defined as the information technology applied to teaching and learning for l) the delivery of educational material, 2) the guidance and facilitation of the learning experience of the student, and 3) the support of collaborative learning and communities of learners. How the new technology is adopted is related to l) the users' interest in doing what they do well and in a better way, and 2) the users' interest in doing things of a different nature than the ones they are used to do (see Maddux, Johnson, and Willis, 1997). It is important to emphasize that both uses of technology are relevant to classroom learning.

The thrust of research on the use of online technologies is to support the development of teaching practices and curricula which give numerous opportunities to the learners to use the resources and tools in autonomous, creative, and collaborative ways. This work is more recent, thus at an earlier stage of development. Initiatives include the work of Bereiter and Scardamalia (1993) and Harasim, Hiltz, Teles, and Turoff (1995). Pertinent to this paper on time management, we point to the following trends and issues in elementary, secondary, and university classrooms:

- Higher levels of control by learners are called for as classrooms are getting more online (e.g. responsibility of effective use of time is shared between learners and teacher; time devoted to searching information, and communicating online).
- Learning situations become more realistic and authentic as classrooms are getting online (e.g. time devoted to didactic teaching versus deep understanding of concepts, notions, and principles; time devoted to text elaboration versus multimedia presentations).
- Online resources boost student interest and motivation in the classroom through a greater diversity of learning goals, projects, and outcomes (e.g. the guidance or coaching of multiple tasks occurring at once in the classroom).
- The successful online classroom combines information technology with appropriate pedagogy (e.g. increased time for interactions between learners).
- The classroom is extended to online learning communities with the potential to support or even challenge the locally-established curriculum (e.g. time devoted to face-to-face and online interaction).
- The education of educators is broadened to include just-in-time and/or collaborative learning (e.g. blurring boundaries: web-extended courses, prerequisite courses, undergraduate/graduate courses).

- The university classroom is also being transformed as a new mixed mode of learning emerges (face-to-face and online learning activities), thus making information access more direct, interactive, and flexible, and testing collaborative learning arrangements in a great number of ways.

Related to the above trends, are professional knowledge areas to be investigated in order to manage time effectively in and beyond the networked classroom.

Emerging Patterns of Time Management

As we assist pre-service teachers, in-service teachers, and other educators gaining knowledge and skills of a practical or intellectual nature which they are called upon to master, we uncover new possibilities, experiment new practices, and reflect on results. A technology of use (see Scardamalia, Bereiter & Lamon, 1994) for teacher education is in development, that is, the intentional and deliberate use of technology to foster professional knowledge at a number of intersecting levels.

In the literature on distance learning, the use of time is mainly considered from the point of view of the learner — lifelong learning as well as learning anywhere and anytime being the key notions that capture the essence of the possibilities that learning networks enable and support. Our own reflective use of electronic networks for professional development is grounded in local PDSs' activities. bring us to consider a network as "a shared collaborative space" that departs from the basic linear sequence of action prevailing in another shared space, that is, the classroom (e.g., a workshop, a course, or a program): pre-action (planning), inter-action (intervention), and post-action (evaluation).

As the networked-enabled classroom takes shape, be it at the school or at the university levels, the time and space boundaries that defined and brought order in the classroom are blurring. The availability of online resources creates new learning and teaching opportunities, challenges, and issues. The teachers (preservice and inservice teachers as well as teacher educators) that are exploring the possibilities of online resources and tools for learning purposes are at the forefront of an emerging professional practice, one still very much unknown but one that could move us beyond fragmented teaching/learning units (human interaction or human-computer interaction), and into hybrid learning environments likely to seriously challenge current time management practices.

Emerging patterns in what appears to be a socially organized activity in need of redefinition may be clustered as follows:

Interacting With Others Before, During, and After Class

Courses are getting web-extended. This means 1) that students may consult information about the course ahead of time, the professor's web page, or the course web page; 2) that course activities may be conducted throughout the weekly student schedule; and 3) that courses extend past their regular schedule; etc. Thought of as interactive systems of activity in a shared collaborative space (for instance, TACT, the TL*PDS created out of the collaboration between Laval University and associated schools and universities), one may observe 1) incoming participants getting information and communicating with more advanced participants in order to plan their learning/teaching activities; 2) individual participants coordinating or evaluating their activities; 3) participants engaging in sustained collaborative activities such as the writing, in co-operation, of a professional journal, or the elaboration of a database. As these new patterns of activity emerge, the extended course or practicum transforms itself into a community of learners. With respect to time management, regularities may concern an individual interacting at different times in a community, or participating in different communities of learners (see Greeno, 1998). Along with him, we are convinced that it is a propitious time to explore ways of integrating the two following lines of research:

> Cognitive science analyzes structures of the informational contents of activity, but has little to say about the mutual interactions that people have with each other and with the material and technological resources of their environments. Interactional studies analyze patterns of coordination of activity but have little to say about the informational contents of interaction that are involved in achieving task goals and functions (p. 6)

It is unlikely that the principles of coordination that have underlined time management for so long in the classroom will remain intact in a networked learning environments. As we uncover the affordances that support a variety of asynchronous/synchronous interactions in a TL*PDS, new patterns of time management will be conceptualized. Activity being "a continual negotiation of people with each other and with the resources of their environments" (Greeno, p. 9), networked learning environments are transforming teaching and learning activities in ways that are forcing the uncovering of new regularities of practice relating to time management, both within the classroom between teacher and students, and within the school, board and profession between teacher and teacher. As our pioneering research evolves, we see current coordination patterns being challenged not only during the inter-active phase, but also during the pre- and post-active phases.

Planning on a Longer Time Scale

An additional implication with respect to time management in a TL•PDS is the increased time scale within which we design professional development activities: rather than the traditional isolated or short-term events (a scale of days or weeks), we envisage a series of activities extending over a much longer period of time (years). The changing time scale requires the other time management modifications mentioned in this paper: Educators accessing educational resources on the networks, or using the networks to engage in professional dialogues, at any time, on their own time at home through dial-up access to the Internet, or from their classroom computer as part of classroom time reorganize to allow students and teachers to learn. In other words, extended professional development in a TL•PDS requires educators who stay connected.

A concrete example of such a design is the TL•PDS in Montreal (McGill University and associated schools, http://www.education.mcgill.ca/olit/institute/, involving a blend of student-teachers, practicing teachers, and teacher educators. The Summer Institute is the centre of gravity for learning activities that extend during the whole year: students from the Faculty work together with teachers from the school in which they will be doing their field experiences in the months following the Institute. The learning activities during the Institute revolve around authentic, school-based projects to design or improve the design of the school web-site in support of student learning and professional improvement of educators. The work that is conducted during the Institute therefore affects other activities that place months after the Institute. The teachers returning to their school after the Institute can remain "connected" with the student teachers, via the telelearning tools that they have learned to use during the Institute, and therefore the time between the Institute and the field experience does not imply a disconnection between the participants.

Evaluating Participants' Past and Future Ways to Contribute Effectively to One Another's Learning

The third basic element of the teaching sequence, post-action, includes the ways which encouraged and supported participants' contributions to the community of learners as well as the ways in which future participation might occur, and be structured. At this design stage of the TL*PDS, it is important that opportunities be provided for the construction of shared understandings of teaching and learning in networked learning environments. For instance, preservice students create databases that inservice teachers use, and build on. Graduating preservice teachers who have worked in networked junior high classrooms have practices and reflective analysis to share with incoming student-teachers. Teachers that are integrating online resources and tools into their classroom have recognized different possibilities of organizing educational activities, ones that they want to discuss with other practicing teachers (assumptions, goals, roles, processes, tasks, procedures, and the like). Teacher educators engage in more continuous interactions through time as they become integrative agents of theoretical perspectives and practices within learning communities.

Conclusion

From our own reflective analysis on how telelearning technologies enhance and shape our practice, we identified the above emerging patterns of time management. They all contribute to the creation of functional

asynchronous collaborative communities of inquiry. As the TL*PDS evolves as a complex dynamic system, it is likely to encourage participation in new practices of inquiry and sense-making that foster teachers' identity as lifelong individual learners and effective participants in the learning communities that will help them become better informed practitioners.

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TEbase: Connecting Preservice Teachers and Technologies Via Web-Enabled Databases

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Abstract: This paper describes web-accessible databases which form the core of three similar resources for infusing technology into teacher education. The Technology Competency Database is built around the NCATE/ISTE Foundation Standards. Projects in a master's-level distance education course employ a variant called CTERbase. Undergraduate courses make use of competencies-linked activities databases known as TEbases. Each kind of web-enabled database allows students to enter descriptive information which teachers evaluate with grades and written responses. Exemplary student work can automatically be published for other students to see. Research and design initiatives are coupled with formative evaluation as part of ongoing development of these resources.

Preparing preservice teachers for classrooms of the 21st century poses new challenges in the wake of rapidly changing technologies throughout our society. As electronic resources for learning become increasingly important to schools across the country and around the world, technology instruction needs to become a major integrated component of preservice teacher education programs. Too often, this is still an unmet challenge, owing to lack of time in the curriculum and unclear instructional focus. Curriculum restructuring is an important step on the road to reform.

For the past three years, the teacher education program at the University of Illinois has engaged in curricular reforms to promote constructivist learning and provide strong foundational skills in instructional technology. What began as a pilot program for a select group of senior-year students was expanded in Fall, 1998 to cover all juniors and seniors pursuing certification as elementary or secondary school teachers.
In support of these program reforms, there has been ongoing development and formative evaluation of a set of instructional resources known as Teacher Education Databases, or TEbases. This paper describes the historical, current and planned uses of TEbases as aids to educational reform.

Background

TEbases first took shape as a Technology Competencies Database (TCD), built directly upon the NCATE/ISTE Foundation Standards. The TCD was developed at the University of Illinois during the 1996-97 academic year and piloted in 1997 and 1998.

The TCD is built around a web-enabled database created with Claris Filemaker Pro 4.0. The databases are linked via Filemaker's WebCompanion to a set of web pages running on a Macintosh server in the University's College of Education. Each student has access via a password to her or his own record in the database. Via the web pages, students can submit to the database information about how they have

met the competencies, in the form of written descriptions and URL pointers. Their instructors have access to a separate set of web pages allowing them to view the students' records, grade the submissions, and provide written feedback about the students' work.

Student work which has met with faculty approval can automatically become available for other students to see and learn from. In this manner, the somewhat dry language of a set of competencies becomes the basis for a rich exchange of ideas among a group of learners. For students, the end result is an individualized "electronic portfolio" linking to their best work, which can be of use to them in reviewing what they have learned and in searching for work after graduation.

Working with the TCD throughout their preservice program, students develop the competencies through different course experiences. Students might first satisfy a competency during a course experience by giving a simple example, but as they have opportunities to observe a body of best practices they might later meet the competency in another way and revise or supplement their first efforts. When students interact with faculty members via the TCD, they engage in reflective processes, display their knowledge, and negotiate meanings in individualized ways. The TCD is also an avenue through which elementary and secondary education faculty increase their own technological competencies because they need to assess the appropriateness of student submissions. Faculty at each institution work together to create the exemplars and criteria needed to assess student submissions.

From TCD to CTERbase

Formative evaluation efforts between Spring semester 1997 and Spring Semester 1998 has given us insights into the strengths and weaknesses of the TCD. Students and faculty members found the TCD easy to understand and use, and students added to it regularly. However, faculty in a class using it on a voluntary basis had great difficulty keeping up with the workload imposed by the TCD. A major factor appeared to be the fluid nature of the TCD itself – because students were invited to tackle the competencies in any order they chose, their teacher was faced with a bewildering array of information to evaluate. At the end of the 1997-1998 school year, fewer than half of the descriptions submitted by students had been graded. This led the developers to wonder if the TCD might be adapted to serve better the educational goals of teachers, as well as the students.

Two new kinds of course offerings within the College of Education in recent months have allowed us opportunities to redesign and enhance the usefulness of the TCD in major ways. In Summer, 1998, the College began offering via distance education an online master's degree program in Curriculum, Technology, and Educational Reform (CTER). The CTER program was created to afford an opportunity for practicing K-12 teachers around Illinois and elsewhere to earn an advanced degree while building up their skill set with educational technologies. The 26 students in CTER's first cohort group are working toward completing an eight-course, two-year program which offers theoretical and practical instruction in resources, methods, critical evaluation, and societal aspects related to teaching with technology.

Instructors who taught CTER courses realized that they would need a mechanism to allow their students to submit their work online, have it graded, and receive feedback. It turned out that a suitable mechanism for this already existed in the form of the Technology Competencies Database. By taking out the descriptions of NCATE/ISTE competencies, and replacing these with short descriptions of assignments due, a mechanism was created which could support project-based learning for individual students. Just as with the TCD, users of this initial version of the newly dubbed CTERbase could submit descriptions and URL pointers for their teachers to evaluate, and the teachers could provide grades and written feedback. To supplement the project-based CTERbase with competencies-based instruction, students in the summer course were assigned as one of their activities during the semester to complete the original TCD; this assignment offered them an opportunity to "measure" their learning individually according to the NCATE/ISTE Foundation Standards.

The Summer semester's trial use of a CTERbase showed us that a web-enabled database could support instruction at a distance. Based on this success, use of CTERbase was continued in another CTER course offered in Fall, 1998. In this course, the 26-member CTER cohort were joined by nine on-campus UIUC students. Group projects were a major component of the Fall, 1998 course, which focused on educational evaluation. Therefore, an additional, key feature was added to the CTERbase which supported

this course: the ability to create groups, each with its own assignments, for which descriptions and grades would be matched with sets of individual students' records.

The Technology Strand

In the 1998-1999 school year, the College of Education at UIUC began implementation of a redesigned teacher certification program. Included in this redesign was a new course, Curriculum & Instruction 235: Content Area Applications of Educational Technology (referred to hereafter as C&I 235). In this new program, preservice teachers are not required to take a separate introductory course in the use of technology in education. Instead, the technology instruction is stranded through all the preservice courses, early field and student teaching experiences. The activities for the technology strand are based on the NCATE /ISTE Foundation Standards. In this framework, students are actively engaged in learning how to use technology in their content area or grade level and how to develop and implement lesson plans that will include the use of technology in their teaching. From our previous research on the level of technology experience of students coming into the teacher education program, we assumed that students would have basic familiarity with word processing and web browsers, although there are some students who come into the program with much more technology expertise.

This stranded course is coordinated by a faculty member experienced in the use of technologies across content areas and grade levels. A course syllabus was developed to be implemented over a two-year period. A number of meetings between the content specialists and the technology instructor were held to discuss what kinds of technology would be most useful for faculty and students to use in their teaching and learning. Hands-on instruction was provided in a computer lab setting by various content specialists and teaching assistants with support from the coordinating technology instructor. Five major topics are included in the technology strand: Computers in the K-12 classroom, Computer networks, Instructional & classroom management strategies, Social issues, and Keeping current with technology.

Implementation of the New Curriculum

The C&I 235 "distributed course" began in the Fall, 1998 semester. Students in four content areas in the Secondary Certification Program were given hands-on instruction in a computer lab throughout the semester within the context of a required course in the redesigned program, Teaching in a Diverse Society. This gave the teacher education faculty an opportunity to refine the syllabus integrating technology activities while gaining familiarity with technologies.

During this first semester, students learned how to use email for one-to-one communication and web-based asynchronous conferencing systems for group discussions. Students were assigned readings related to the use of technology in K-12 classrooms, searched the World Wide Web for content related resources, and learned how to evaluate the content of web pages and CD-ROM software for use in their content areas. Students also learned how to create personal web pages and upload files to a student server. Based on the course content, some students also began using digital cameras, presentation software, graphing calculators and spreadsheet programs. As students completed these assignments, they submitted them to a C&I 235 TEbase for grading.

The C&I 235 TEbase

The reconstituted TEbase has become an organization and management tool for students and faculty. Students use TEbase to submit individual and group assignments for each course taken over a two-year period. Using a web interface, these assignments can be typed directly into the database or students can enter a URL that points to the location of their assignment (usually linked to their personal homepage or web-based discussion archive) that can be accessed at a later date in the development of a professional portfolio which is a requirement for graduation. At the present time, all students are required to develop a hard copy portfolio although we are beginning to see many students developing both a hard copy and an

electronic portfolio we call e-portfolio. This portfolio will be used by students looking for teaching positions after graduation and later in their professional careers.

While students use TEbase as an organizational tool, faculty use TEbase to provide students with feedback on their assignments, grade and record assignments, track students progress of their work, publish exemplary student work, and map technology standards to the different assignments. While teachers do have the option of requesting paper copies of the assignments, faculty have expressed appreciation for the ease of using the Web to access students' assignments either from the university or their home.

The secondary content area courses are taught by different faculty members, each with their own teaching style and focus, so technology activities identified by the technology instructor have been adapted accordingly and integrated at different times during each semester. Since students use technology in each of their courses throughout a two-year period, TEbase was redesigned after the first semester of implementation to monitor technology assignments and competencies by student rather than by course. This redesign was needed to help the technology instructor monitor the integration of technology into the content area courses across the entire certification program, to provide a more flexible database to accommodate unlimited numbers of activities, and to provide a tool for faculty that is easy to use.

The TEbase Results

In Fall, 1998, there were six junior-year education classes using TEbases: two elementary education methods classes and four methods classes for students preparing for secondary-level certification in math, science, English and social studies. In all, there were 74 elementary education students and 148 secondary education students using the TEbases. Each TEbase was built around a different set of activities, and all of these activities were related back to the 18 NCATE/ISTE Foundation Standards.

By the end of November, it was apparent that the TEbases had been adopted as integral parts of their respective courses in all but one instance. It had been used to record five observation assignments in each of the two elementary methods courses, for seven activities in the secondary social science section; for five assignments in the secondary math section; and for 14 assignments in the secondary science section. In the secondary English section, the teacher did not use the TEbase with her students but the technology course coordinator used it to track two assignments with those students.

There were few difficulties with the technical operation of the TEbases. Nearly 2,000 logins had been recorded as of Nov. 30, with fewer than a half-dozen students reporting difficulties (in all but one case the problem was an incorrectly entered login name or password). Most encouragingly, there was no evidence of any shortfall in grading or provision of feedback for any of the courses using the TEbases, in marked contrast to the previous year's experience with the Technology Competencies Database. In the TCD and TEbase grading scheme, work that is judged acceptable appears on the web page with a "star" icon for a grade, and exemplary work is given a "double star." Work awaiting a grade appears with an "hourglass" icon, while work which requires revision receives a "question mark" icon, and assignments which the students have not yet attempted appear with "blank" icons. As of Nov. 30, 1998, the breakdown of grades awarded by class was as follows:

- Elementary classes (74 students on five assignments): 292 stars; 7 hourglasses; 57 blanks; 14 question marks
- Math class (36 students on five activities due to date): 45 stars; 1 double star; 8 hourglasses; 120 blanks; 6 question marks
- Science class (25 students on one assignment due to date): 7 stars; 3 double stars; 7 hourglasses, 8 blanks
- Social science class (33 students on six assignments due to date): 160 stars, 11 double stars, 10 hourglasses, 8 blanks, 9 question marks
- English class (54 on 2 assignments): 85 stars, 23 blanks

In total, 604 submissions were graded acceptable (star) or exemplary (double star) during the period ending Nov. 30, 1998. Decisions were pending (hourglasses) on 32 submissions, for a grading completion rate of 95 percent. In many instances, the teachers supplemented these grades with written feedback, adding to the pedagogical value of the grades awarded. (It remains to be learned how this

feedback would compare in substance and length to what instructors might have given had the assignments been completed on paper.)

Discussion

Handler and Strudler (1997) recommend that the NCATE/ISTE Foundation Standards should be integrated systematically into the curricula of teacher preparation programs, in ways which might vary from one context to another. Our experience provides strong support for this recommendation. Whereas the initial instructor and graduate assistant were unable to grade more than 50 percent of the 176 competencies descriptions submitted by their students even by the end of the school year, the teachers and coordinator of the Fall, 1998 classes were able to grade 95 percent of their students' submissions soon after the submissions were made. Individual differences between this year's and last year's teachers and students may account for some part of this, as may the shift from voluntary to required participation. Yet it appears likely that in large measure the improvement is due to the difference in activity types. The activities in the Technology Competencies Database were the NCATE/ISTE standards themselves, and students were instructed to complete these in any order they chose. The activities in the TEbases were the instructors' own assignments, and these were due in a specific sequence on specific dates. We believe the improvement we have found offers strong evidence that it is more efficient to give instructors the leeway to set their own assignments in the TEbase than to require them to grade students' completions of the competencies.

The TEbase mechanism performs several important bridging functions within UIUC's new teacher education curricula. First is the bridge between individual class activities and the ISTE Foundation Standards. Methods teachers and the technology course teacher work together to construct assignments which promote learning in each competency area. Second is the bridge across courses – the TEbases function as electronic gradebooks which operate much the same from one class to the next, permitting students and faculty members to track learning consistently across the two-year program. Furthermore, the TEbases offer bridges between individual learning experiences and a coherent body of knowledge. At the individual level, this coherence takes the form of an electronic portfolio which each student can point to as documentation of their learning about educational technology. At the social level, the TEbases' ability to automate publication of exemplary work allows students to contributed to a high quality web resource that grows into something of value not only to the particular students and faculty, but to the educational world more generally.

There is a great deal more to be learned about the workings of the TEbases, and how they may be adapted further in order to ensure that the promise of instructional reform contained in the new teacher education curricula is in fact met. For this reason, we will be embarking in the coming year on more formal evaluation procedures, to investigate in an unbiased manner whether the benefits we think are occurring really are. Our course of action so far has been a continuing cycle of design-evaluation-adaptation. We believe this general course represents the best manner of attaining an optimal match of resources and curriculum. As evaluation efforts are formalized in the months ahead, we believe it will be important to maintain close ties to the evaluation itself, so as to benefit maximally from the process of investigation.

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The Use of Web-Sites for Offering the First Two-Years of General Education: The Integrated Curriculum for a Science or Engineering Program of Study

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Abstract: This paper describes the contents and results of a pilot program of study for freshmen engineering students at a medium sized private university. The specifically designed courses incorporate active learning, strong teaming, use of common computer technology, team design projects, and a variety of well-documented assessment practices. A major component of this program is the use of the campus network and the Internet for all courses in the program: each course has its own web-site on which are posted all daily lessons, tutorials, reference materials and exam results. In addition, students in the program can communicate with faculty and with each other via forums, emails, and group communications. Although the students were drawn from engineering, the underlying philosophy is applicable to a wide spectrum of programs of study as well as the general education component of many degrees. In particular, it should be of interest to colleges and universities that offer degrees in teacher education, particularly programs in mathematics and science.

Introduction

Embry-Riddle Aeronautical University (ERAU) has completed the third semester of a pilot project for an Integrated Curriculum in Engineering (ICE). Sixty-five entering freshmen engineering student volunteers began in the Fall 97 semester and were placed into specifically designed sections of calculus, physics, humanities, and introductory engineering courses required of all engineering students at ERAU. These sections incorporate active learning, teaming, use of common computer technology, team design projects, and weekly assessment of progress.

Background

For many years faculty in both Mathematics and Physics have recognized that the freshman calculus and physics courses were very disjointed. The topics taught in calculus were not in line with topics covered in physics. Although we teach calculus as a support to physics, this was not at all clear to the students.

In addition, we were concerned with the high attrition rates of engineering students. Finally, in 1993 a group of faculty from Mathematics, Physics, Humanities and Aerospace Engineering started to meet regularly to seek better ways of educating the engineering students. These discussions focused on the NSF initiated Engineering Coalitions (Winkel & Froyd 1992). In particular, the Foundation Coalition, headed by Texas A&M University (TAMU) (Glover et al. 1992) which uses an integrated first year program (Glover & Erdman 1992), pioneered at Rose-Hulman Institute of Technology (RHIT) (Rogers & Winkel 1992), and adapted by TAMU (Erdman et al. 1992), was of interest to the faculty at ERAU.

The faculty team from ERAU visited both RHIT (Froyd et al.) and TAMU (Barrow et al. 1996) to observe and learn about each of the integrated program models they had developed and adopted. Although each program had

similarities, it was the TAMU program that the ERAU faculty decided to use as the basis for our Integrated Curriculum in Engineering (ICE) program.

Studying what was occurring at other colleges led us to begin to examine the detailed content of our courses, when these courses were taught and how they were taught. What became the eye opening exercise that really demonstrated the misalignment of the calculus and physics topics was when the faculty generated a matrix with all physics topics down one side and all the calculus and differential equation topics along the top. As an example of the misalignment between the two courses, our matrix showed that some topics in physics which required knowledge of vectors was being taught in the first semester course, whereas vectors were not being covered in calculus until the third semester. In addition to redesigning the content of the mathematics and physics courses, we decided to also incorporate teaming, active learning and the use of technology into the daily content of all the courses we would offer in the ICE program.

Physics and Calculus Content

The first problem to be addressed was that of the misalignment of topics between physics and calculus. Upon close examination of the topics in the matrix, we found several instances of serious misalignment of topics. In the first week the physics course was using vectors which included the dot and cross products. Vectors topics were not covered in the calculus sequence until the third semester. Also, the physics course used differentiation much earlier than it was being taught in calculus. However, the most surprising topic covered early in physics was the notion of a line integral. Although they were very elementary line integrals, this topic was not even mentioned in the calculus sequence at all. In fact, line integrals were not covered until the advanced engineering mathematics course. (Tab. 1) illustrates the topics covered in the first five weeks of the semester in a traditional freshman calculus and physics course.

Week	Calculus Topics	Physics Topics
1	Review graphs, lines and functions	Introduction to scalars and vectors
2	Trigonometric functions, Limits and properties of limits	One dimensional kinematics (No differentiation or integration)
3	Properties of limits, Evaluation of limits; Continuity; Infinite limits	Two dimensional kinematics; Circular motion.
4	Derivative; Basic differentiation rules	Force; Newton's Laws
5	Product and Quotient Rules; Higher order derivatives	Free body diagrams; Applications of Newtons Laws

Table 1: Traditional Calculus and Physics Topics

Although we accepted on principle that calculus was a necessary support to physics, our curriculum did not reflect that; we were expecting students to use mathematical principles in their physics curriculum that they were not being taught till later. Once the problem had been defined, it was apparent that the topics in the calculus sequence needed to be reordered. It was decided that the calculus sequence needed to follow the needs of the physics course. In order to gain some time at the beginning of the semester the first topic in the physics course was optics, a topic that required no calculus.

Keeping in mind that our goal was an Integrated Curriculum, we aimed for a program in which the math was taught, then used and re-enforced in physics. The first topics in the ICE calculus I was functions and parametric equations. This enabled us to then define vector-valued functions and polar coordinates. Next differentiation was introduced and applied to vector-valued functions as well as the traditional collection of functions. This allowed us to immediately cover integration of polynomial and simple trigonometric functions. With vector-valued functions and integration covered we were then able to introduce simple line integrals before they were needed in physics. These are only a few examples how calculus was reordered, so that the mathematical concepts were first taught in calculus before being used and applied physics. (Tab. 2) illustrates the reordering of topics in the first five weeks of the ICE program.

Week	Calculus Topics	Physics Topics
1	Functions; parametric equations	Introduction; Basic quantities; orders of magnitude
2	Vector addition, vector properties	Geometrical optics; refraction
3	Vector-valued functions; Polar coordinates; Limits	Mirrors and lenses
4	Continuity; Properties of Derivatives;	Optics
5	Product and Quotient Rule; Chain Rule	One dimensional kinematics using differentiation

Table 2. Calculus and Physics Topics in ICE

Course Format

Integrated courses across the curriculum

Another important goal was to align the entire curriculum for first year engineering students, including mathematics, physics, humanities and the introductory engineering course. In addition to linking courses across the curriculum, we also wanted to enhance the delivery of the courses by using active learning as appropriate and to foster in students an attitude of shared responsibility for their learning. We rewrote the content of every course in the ICE program with these goals in mind.

Technology in the classroom

In cooperation with our Informational Technology department we set up a website for each course in the ICE program. On these websites we posted the syllabus, daily lessons, team problems, exam reviews and solutions and any reference materials the instructor wanted the students to have. Having the worksheets posted on the web allowed the students access to them prior to class as well as in class on their laptop.

Active Learning and Teaming

In calculus, we produced daily worksheets for the course (Fig. 1). These worksheets were standardized to include the following information. The objectives for the lesson were stated at the top of each worksheet. Next were three or four exercises representative of the concept to be covered. Then the text reference and homework were listed at the bottom of these worksheets.

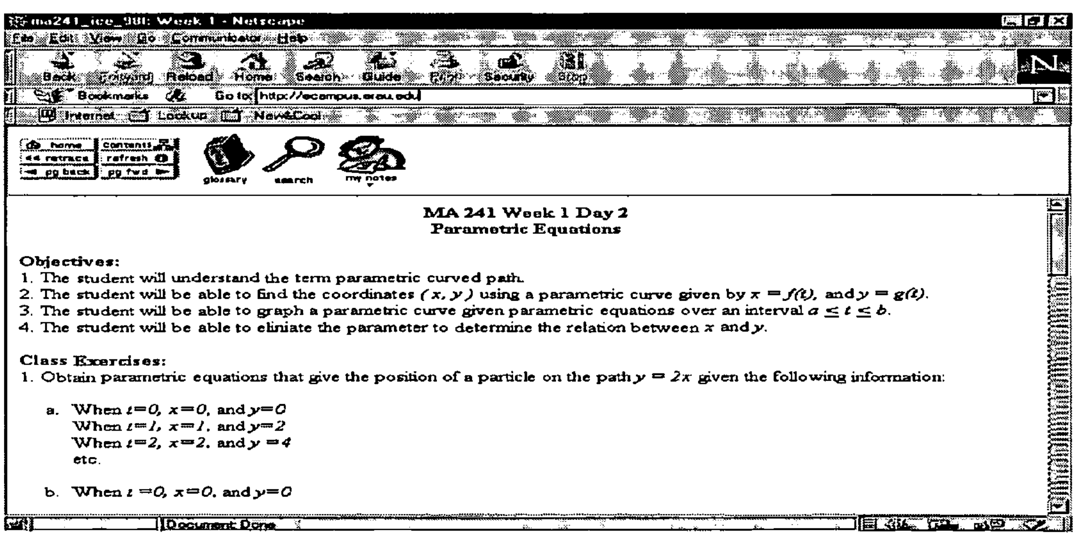

Figure 1: Example of a Daily Worksheet

In class, the students would work from these worksheets in their teams. The instructor would give a short lead-in to the topic to be covered, and then the students would discuss the exercises on the worksheet. Care was taken when preparing the class exercises to accommodate active learning. One exercise would require the students to explore and develop the concept in their teams, and then the next exercise would be an applications type problem. In this way the students were involved in the derivation and not just using a formula.

After working on the problem for a set amount of time, the instructor chooses a team to present the solution to the class. In some cases the solution a team gives may not be completely correct, which prompts a general discussion on the problem. This additional class discussion proved to be very useful in identifying the problem area for the students, which could then be clarified by the instructor.

In addition to working in teams in class, several team problems are assigned to the students throughout the semester. These problems are more challenging and may cover multiple concepts. These problems are submitted in report format with each team member signing the cover sheet to indicate his/her participation in the solution. One team is chosen to present their solution. Students grade the presentation for accuracy, clarity of presentation and style.

Common Computer Technology

In developing the ICE program we agreed that there should be some standard software used throughout the program. For word processing and data analysis, Microsoft Office was chosen. This included Microsoft Word, Excel and Powerpoint. The engineering department had adopted Bentley Microstation as the computer graphics software, so it was also used in the ICE program.

In recent years there has been more and more use been made of Computer Algebra Systems (CAS) such as Maple in the teaching of Mathematics. Over the past few years we have incorporated the use of Maple into our calculus sequence. However, this came in the form of being in a computer lab one day a week and using Maple on assigned problems. Everyone involved in the ICE program had taught one or more of the calculus sections using Maple, so it was agreed to use Maple in the CAS in the ICE sections of calculus.

Unlike the traditional sections where the student went to a computer lab one day a week, the students in the ICE program would use Maple on a daily basis on their laptops. In fact, we wrote the exercises on the worksheet to incorporate and encourage the use of Maple. Having the students use Maple has allowed us to challenge them with problems that require more complex algebraic manipulation or do not have nice integer solutions, yet still illustrate the basic mathematical concepts. Maple has been especially useful in the multivariable calculus course. The plot package allowed a much more visual approach to some topics.

Assessment

We have gathered assessment data in numerous ways. The ICE faculty meet weekly to discuss where each course is in its planned program and the progress of each student in each course. We used plus/deltas - anonymous written comments on post-it notes to the instructor about anything positive in the course and suggestions for improving anything in the course that is not working. Also, a town meeting of all students and faculty is held three times a semester; this enables students to ask questions about anything they wish. Immediate feedback is provided to the students in the framework of the town meeting.

A student/faculty advisory committee meets every other week to share additional information from the students. These matters are fully discussed by the ICE faculty at their weekly meeting.

Formal assessment of the students is done using surveys constructed by the Office of Institutional Research. Also, comparison data with students not in the program is collected. This data included the number of completions, withdrawals, grades, GPA and retention.

Offer

The authors are quite willing to share additional in depth information with any institution -- high school, community college, university -- that wishes to learn more about these matters. Faculty who wish to visit ERAU to observe the ICE program in action may contact either about arranging a visit.

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HyperGroups: A New Tool for Enhancing Communication in an Electronic Community of Learners

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Over the last two decades, the growth of the Internet has truly been staggering. Electronic communities have flourished as hardware, software, and network infrastructures have become more accessible, more affordable, and simpler to use. In education, we have witnessed an extraordinary evolution, from the days when only a few educators were familiar with the Internet, to today, when almost all educators have access to email, the web, and other Internet resources. On today's college and university campuses, electronic communication between students and faculty is a common occurrence, and new electronic communities are forming as educators and their students use online communications resources to discuss issues related to their courses. With the growing popularity of distance education, asynchronous discussion mechanisms are an essential part of most online course management system or OCMS (Graziadei, 1997). They also serve as the primary communication channel for other kinds of virtual communities including special interest groups (SIGs), discussion forums, committees, collaborative workgroups and the like.

Mailing Lists

Long before the emergence of the web, email was one of the early services to become popular on the Internet. As early as the mid 1970s, email distribution lists were being used for asynchronous, one-to-many and many-to-many communications (Bennahum, 1996). Named distribution lists containing hundreds or thousands of email addresses were kept on mainframe computers connected to the Arpanet (the Internet's predecessor). Participants could share their messages with the group by sending their message to the named list (e.g. wine-lovers@ucb.arpa). The message would then be copied and delivered to each person on the list.

Mail lists worked quite well and caught on rapidly at participating universities as the early Internet continued to grow. However, this arrangement had numerous problems and limitations. It resulted in a significant burden on the list administrator because many requests would arrive each day from users wanting to be added or removed from a list or wanting to receive missed postings and additional information. The administrator would also need to contend with daily batches of mail delivery errors many of which were the result of invalid email addresses submitted for addition to the list. Running a large list was reported to have become a full-time job at a number of sites (L-Soft International, 1996).

Out of this was born the idea of a list server or "listserv" that could automate many of these administrative tasks. Eric Thomas --- cited by many as inventor of the list server --- began development of his list server in the mid 1980s, a system which he named LISTSERV. He conceived of a list server as an autonomous software agent that would

respond to user requests sent to it via email. This meant that users could interact with a list server using the same email tool they already used to communicate with their friends and colleagues. Initially, users were allowed to subscribe to, unsubscribe from, and request general information about a given list and also to request a list of lists that the server managed.

Other features evolved in response to the needs of the user community. A verification step was added to the subscription process to insure that invalid address weren't added to the list and unwanted third-party subscriptions weren't accepted from hackers. Archive mechanisms were added so that a request could be made to retrieve past messages from a list's archive. Also, a "digest mode" appeared in most list servers that allowed an entire day's (or week's) postings to be collected into a single message that would be sent to the members requesting this mode of delivery.

List servers have remained in this form up to the present day and are still widely used. These packages have been ported from the mainframe to today's popular server platforms including Linux (Unix) and Windows NT/95/98. Two popular packages are Majordomo for Unix/Linux (freeware available from Great Circle Associates at ftp://ftp.greatcircle.com/pub/majordomo/) and LISTSERV for Windows NT/95/98 (commercial software from L-Soft International, http://www.lsoft.com).

Usenet Newsgroups

Another form of asynchronous group conferencing to emerge during the 1980s was the Usenet newsgroup. Newsgroup reader software of the day was designed solely for the rapid browsing of sets of messages posted to a given forum or "newsgroup." Newsreader programs displayed related messages together, usually with responses indented beneath the message that began a new discussion topic. Users of list servers have traditionally complained that it is difficult to follow a discussion on a busy list because messages in their "in box" are displayed in chronological order. But unlike email programs, "threaded" newsreaders allowed users to follow the thread of a discussion visually.

Usenet-style newsgroups are still in operation today but they have evolved in several ways. Local, private newsgroups have become popular for teaching and learning applications as they limit the distribution of a group's messages to a single server rather than distributing them to regional or national news sites on Usenet. Many of the private news servers also allow access to be restricted to a specific set of participants (e.g. students in a course). Newsreaders and servers now typically support multimedia attachments so that messages can contain formatted text with images and attached documents. With both Netscape and Microsoft providing full-featured newsreaders within their browsers, Usenet-style newsgroups are still widely used for asynchronous conferencing. News server software is available from Netscape, Microsoft and a number of other smaller Internet software companies.

Web-Based Conferencing

With the advent of the web and its extraordinary popularity, the development of web-based asynchronous conferencing mechanisms was inevitable. These packages are variously described as "web bulletin boards", "hypertext newsgroups", "web groupware", "web guestbooks", and "graffiti walls" by those trying to put a label on this concept. Web conferencing packages provide easy access to the current and past postings of a group by providing multiple ways of viewing and searching the message titles and content. By exploiting the hypertext capabilities of the browser, web conferencing packages provide threaded views of a group's messages as well as views sorted by author, order of arrival, and subject line. By means of a web form, participants can reply to an existing discussion or post messages to begin a new "thread."

By the close of 1996, it was estimated (Woolley, 1996) that there were more than 60 different software packages for web conferencing. The actual figure is probably a good deal higher when you consider that web conferencing systems are also incorporated into many web course construction packages such as Top Class, WebCT and Web Course in a Box and some web site authoring products such as Microsoft FrontPage. Rather than presenting a feature comparison of these products in the short space available here we will instead describe the development of a web conferencing package the authors undertook to support university course offerings. The evolution of the feature set and user interface is then described. A review of a number of commercial web conferencing packages can be found in the Woolley reference.

The Development of Hypergroups

HyperGroups --- a contraction of "hypertextual groupware" --- was conceived from its beginning about two years ago to be a hybrid email and web conferencing mechanism for use with web-supported courses. Bennahum (1996) and others have observed that email is the most widely accessible application on the Internet even when compared to the web.

For this reason, it has been a design goal from the outset that users should be able to choose to participate in conferencing either through email messages or through a web browser interface. Many students choose to participate in the discussions via email, where messages are delivered to the "in-box," of their email programs, eliminating the need actively search out new messages. However, other students prefer the convenience of a web-based interface, which eliminates the need to launch a separate email program.

In HyperGroups, a discussion forum is called a hypergroup or simply a "group" and within each there can be any number of message threads. A single group often corresponds to a course although a professor may request a set of groups and assign different functions to each (e.g. - announcements, group collaboration, homework submission, etc.) Groups are created by the system administrator and take only a few minutes to create. A creation request needs to indicate the group name (e.g. ECON4203), a brief description or course

title and a list administrator's name and email address. Though we can accept requests through a web form or in written form, most are taken by telephone.

Once a group has been created, the professor (or someone designated to serve as group administrator) uses a web form to subscribe the initial list of students and participants. If that information is unavailable to the professor, she may at the first class meeting instruct the students to subscribe themselves via another web form. The professor also composes a welcome message and posts it to the group. This message may be very brief or it may be an entire course syllabus. The professor may also make a series of postings at the beginning of a term to open discussion topics, present course assignments or distribute reading materials. Preformatted documents can be easily attached to hypergroup postings further facilitating the exchange of information between professor and student.

If students choose to participate in the course via email, they subscribe to the group, although this step is unnecessary if the professor has already done this on the student's behalf. Students may also unsubscribe themselves if they do not wish to receive postings by email and would rather use the web interface only. The description that follows assumes participation via the web browser although in most cases the student could carry out the same action through email messages and list server commands.

Students and other participants are encouraged to begin by visiting the course hypergroup at the URL provided by the professor. Interested readers will find many current courses located in the public course index on our server at: http://www.coe.uh.edu/hypergroups/courses/

In the group index for public courses, as shown in Figure 1, each entry displays basic information about the group and provides buttons to browse its messages (LOOK), to post a new thread (POST), to subscribe (JOIN), to obtain more information (INFO) and to inquire about group membership (WHO). Each button brings up a new screen or form. Students click LOOK to enter the group and are prompted to login if the administrator has restricted access to the group. There they view the group's message activity sorted by author, date, subject or discussion thread. Clicking on a message entry displays the full text of the message. A nice feature of the web interface is that any URLs or email addresses in the body of the message will be displayed as active links.

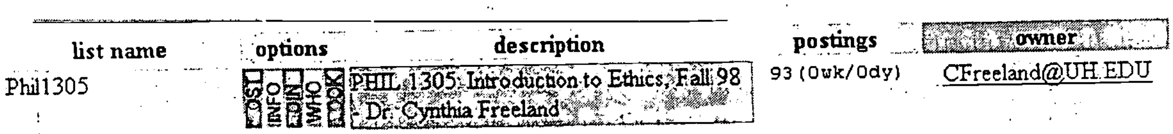

Figure 1. HyperGroup Buttons

Students can respond to any message by clicking a REPLY button in the header and footer of each message. A message composition form appears which presents the standard fields (e.g. To, From, Subject, etc.) that email users will immediately recognize (see Figure 2.) The To field is pre-addressed to the group but the PRIVATE option allows the sender to route the reply to the author of the original message only. The From field must be filled in with the sender's email address as that information cannot always be obtained from the

browser and is often incorrect. The Subject field is initialized with "RE:" plus the subject line of the original message, however users may enter something more informative and the message will still be placed in the proper thread. The message text field scrolls and allows for a plain text message of any size to be composed directly within it. Nonetheless, we recommend the use of a familiar word processor to compose messages of more than a few paragraphs. The completed and spell-checked text can then be easily copied from the application window and pasted to the browser window.

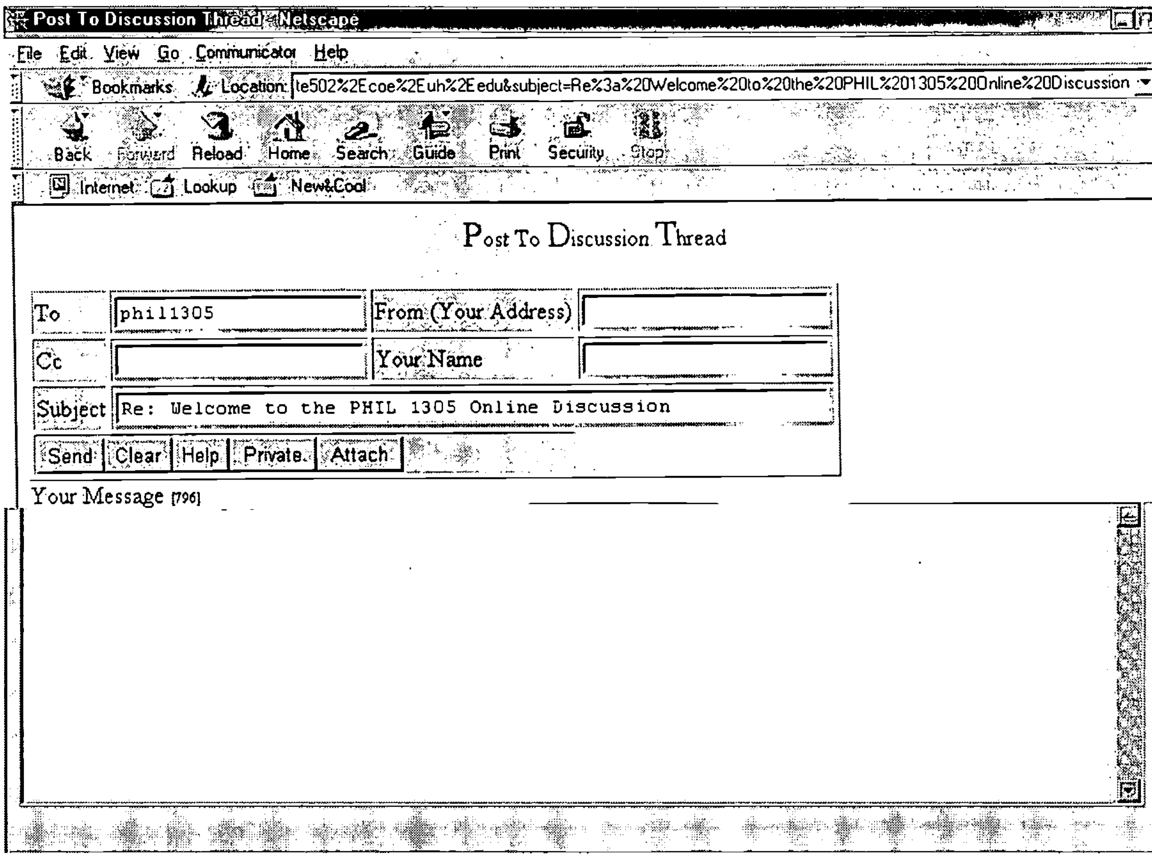

Figure 2. HyperGroup Message Composition Form

The size of a posting should ideally be no more than one to two pages (about 100 lines). Readers sometimes become disoriented reading large quantities of unformatted text. For larger documents, or documents that contain formatted elements, the ATTACH option (see Figure 3) allows users to post a normal text message that will serve to introduce the attached document. The attachment will appear as an active link in the message body and when clicked will cause the document to be downloaded to reader's desktop.

With attachments, care should be taken to insure that all members of the group have an application that can open and display the attached document or that they can easily obtain one. Free viewers can be downloaded from the web for common document formats such Microsoft Word 7.0, Adobe Acrobat 3.0 and many others. Our advice is to include concise information in each message about attached documents including the application,

vendor and version number or come to an agreement at the beginning of a term regarding the attachment formats that will be used by all group members.

Attachments used with HyperGroups can provide an attractive alternative to the creation of original HTML content for online courses. Online course management tools (OCMS) and course design templates can often require weeks or months of preparation before a course is ready for use. But for simple online courses or web-supported courses, a hypergroup often meets the basic communications requirement. Often the material needed will already exist in electronic form (e.g. slides shows, word processor documents, spreadsheets and instructional multimedia) or can be easily scanned from print materials. These materials can be easily distributed to students via HyperGroup's attachment option as needed during the term. Furthermore, students can submit papers and other kinds of electronic documents via attachments.

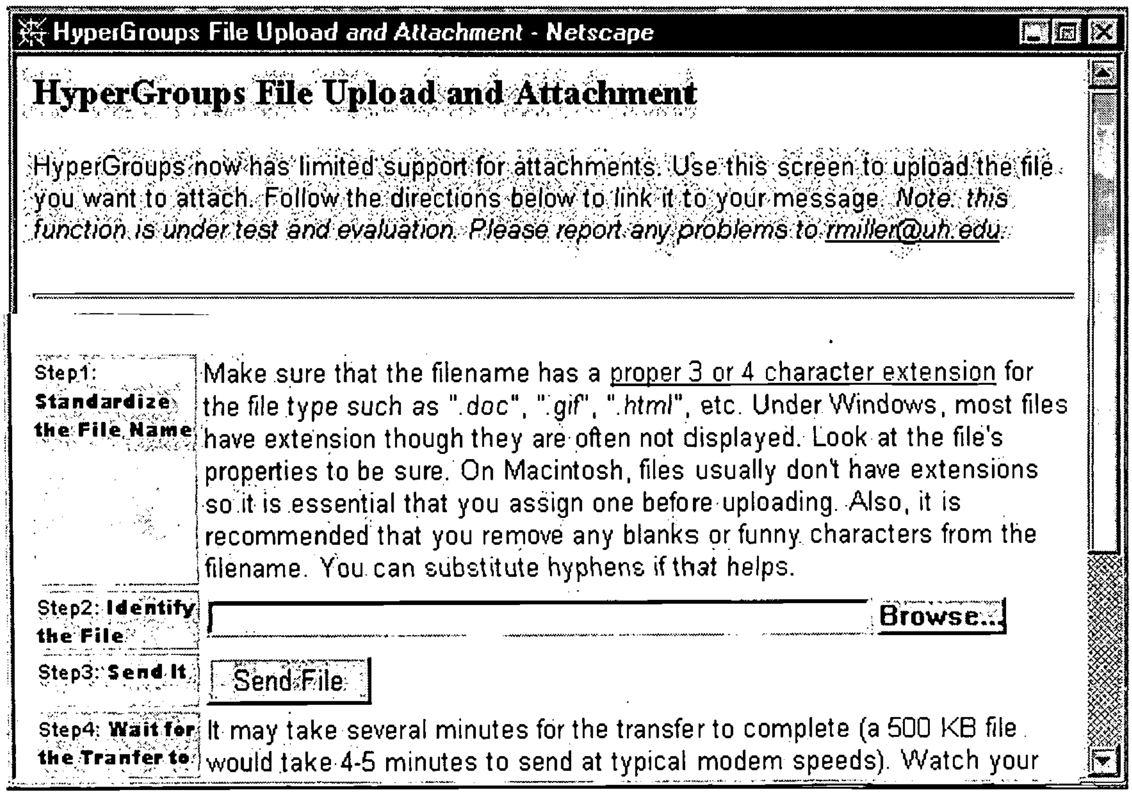

Figure 3. The Help Screen for Using Attachments with HyperGroups

Conclusion

Originally planned as a communication resource only for the College of Education, the use of HyperGroups has spread to other colleges on our campus. The convenience of the Web-based interface and the automatic archiving feature make this a popular communication mechanism for a variety of audiences. Faculty members from many disciplines are using this tool with their students and several departments and program areas are also using HyperGroups as a way to keep discussions going between regularly

scheduled meetings. As the number of users increases, feedback and suggestions are being passed onto the developers. Additional maintenance tools are being discussed which will make HyperGroups an even more efficient and desirable resource that will bring together more electronic communities of learners.

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CREATING AN INTERACTIVE VIDEO CONFERENCING NETWORK: STRATEGIES FOR SUCCESS

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The Southeast Texas Telecommunications Education Network links school districts served by Region 5 Education Service Center into one communications system. The network is part of a statewide effort by the Texas Education Agency to create a K-12 telecommunications infrastructure. The Commissioner' s Access Initiative drives the growth of the infrastructure to provide PEIMS, TAAS and other instructional resources to educators in classrooms and campus offices. The ultimate connection goal of the SETTEN network is to create a telecommunications infrastructure which will be compatible with other regional, state, national and international telecommunications networks.

SETTEN began in the spring of 1997 with a vision to connect educational entities in the Southeast Texas together for the purpose of offering Internet access, data transmission capability and distance education for students and teachers through videoconferencing. Twenty-six local education entities formed the charter membership group to receive internet access and email via high-speed T- 1 transmission lines through an Internet hub located at Region 5's Beaumont site.

The project design involves three stages of installation:

1) Phase I provides for Internet access to all member schools,
2) Phase II integrates videoconferencing capabilities throughout the system,
3) Phase III will link the regional wide area network to other similar networks around the state through connection to the state's Texas Education Telecommunications Network (TETN).

With the completion of Phase I of the project, public school districts in a six-county area now have high-speed access to the Internet and email service through a hub located at Region 5 Education Service Center in Beaumont. The network infrastructure is currently expanding to include additional connections to other educational entities, such as colleges, private schools and other districts outside the Region 5 service area.

Concurrently, Phase II of SETTEN's growth began in the summer of 1998 with the installation of a videoconferencing hub at the Region 5 site. The network takes advantage of the high-speed infrastructure already in place to deliver standards-based videoconferencing to participating members for credit courses, graduate courses for educators and professional development opportunities to the rural communities offered by Lamar University. Video conferencing will provide dual credit courses for high school students.

The SETTEN project is a true collaborative in that each charter member entity contributed a prorated share of the installation costs for the hub and local site equipment needed to obtain Internet access. New members contribute a similar financial commitment to guarantee adequate hub expansion.

Phase II proved to be the most cost-prohibitive part of the project with the high

expense of videoconferencing equipment. Region 5 Education Service Center is helping districts to actively seek assistance with these one-time costs from a variety of funding sources. Grant monies have funded the hardware and human infrastructure costs for installing a video hub at the regional service center and local distance learning classrooms at approximately half of the high schools in the region.

Members share ongoing costs for maintaining a network staff at the hub location, maintenance contracts on the system and periodic upgrades to the system through a cost averaging process. In addition, all classroom sites require a trained facilitator to monitor/troubleshoot the local equipment and to work with the network staff to ensure proper operation of the system.

The network is governed locally by a team of representatives elected by their peers. The nine-member Board consists of six charter member superintendents (one from each county served), Region 5's executive director and two representatives from the Southeast Texas Higher Education Regional Council. With the addition of non-charter members, the board will grow to include other representatives. The SETTEN Management Board is empowered to make local decisions regarding policy and growth issues and meets on a monthly basis.

Representatives from Region 5 schools with distance learning classrooms met in October to plan projects to be implemented in the spring semester of 1999. The group addressed the following regional goals by brainstorming and voting on activities that will receive priority. Those goals and activities are as follows

1) Use distance learning and distributed learning for expanded curricular offerings and meeting the needs of students
   - A. Offer SAT/ACT prep classes
   - B. Summer School courses for high school
   - C. Electronic field trips
   - D. Teacher sharing (AP, Microsoft Academy, Cisco Academy)

2) Use distance learning to provide educational services and information about education to parents and community members
   - A. GED courses
   - B. Nursing courses
   - C. Post-graduate courses

3) Deliver professional development and degree programs for staff and dual credit for students through distance learning
   - A. Staff development
   - B. Post-graduate courses
   - C. Dual credit courses
   - D. Sharing an expert

Training is an integral part of the successful growth and use of the network. Since its implementation, training has been provided in the following areas:

- Basic networking concepts - participants are introduced to the basic terminology of networks and learn to identify integral network components such as hubs, routers, servers, etc.
- Using the Internet to locate educational resources - administrators, teachers and other school staff learn to "surf" to locate areas of interest. They are introduced to the resources offered by websites such as the Texas Education Agency, the regional service center, and others.

- Email - Educators learn to send and read basic mail, build address books and lists, send and download attachments, appropriate protocol for electronic communication, etc.

- Hands-on System Training - Technical support persons receive hands-on training in troubleshooting, maintaining and daily use of hardware installed for Internet and distance learning purposes.

- Fundamentals of distance learning for educators – facilitators, Service Center personnel, college faculty and public school teachers who will be teaching and presenting over the network have received training in instructional strategies and materials for interactive delivery.

Through these varied training opportunities SETTEN will build a human infrastructure to support the operation and programming of the video network.

The interactive network offers many valuable services for the rural school districts. Many small high schools have limited curriculum offerings. Teachers for specialized subjects are not available or the number of students cannot justify offering an advanced class. Teacher sharing among several districts enables each high school to increase their curriculum offerings.

Dual credit courses from the university enable academically talented high school students to receive college credit during the junior and senior year. These students meet the administrative standards of the university and take college courses that fulfill their high school course requirements and carry college credit. Through the video network many rural high school students will be able to earn college credit before high school graduation.

Graduate courses are offered from the College of Education and Human Development at Lamar University. Many educators have the opportunity to pursue graduate degrees or additional professional certification while employed in rural districts. Since many districts seek to develop administrators from among their current faculty, access to graduate courses in their own community is especially important.

The video network brings many educational opportunities to rural communities that do not ordinarily exist in small Texas towns. These opportunities are valuable to residents both for professional development and for personal growth. SAT review courses are offered to assist students and community residents in preparing to take the SAT test. Non-credit workshops offer citizens the opportunity to take classes in organization, tax preparation and other personal enrichment areas.

The collaboration necessary to support and sustain the video network has proved to be a valuable part of the project. The relationship between the university, the school districts and the Region Service Center has been enhanced and extended. The extensive scope of the project has required that business, pubic school educators and university faculty work closely together. Regular communication among all stakeholders has proved to be essential in projects like this one. A variety of methods including video conferencing, email, fax, and phone are employed regularly to ensure that everyone is informed and included.

The SETTEN system has already proven to be a valuable asset to Southeast Texas. As additional districts join the collaborative and the participants explore additional ways to share resources and expertise, the benefits of these technology applications will continue to increase. The vision for the future includes the application of current and future technologies to overcome geographic restrictions and form a community of learners that will benefit the Southeast Texas area.

ARGUMENTATION ONLINE: THE USE OF COMPUTER CONFERENCING

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Abstract: The paper will examine the mechanics of argumentation, some features of computer conferencing software that might support this teaching and learning method (e.g., strategies for sharing, examining and commenting on various kinds of evidence, threading a conversation, indicating type of message, linking to outside information, highlighting new information, different methods for engaging in a conversation and retrieving a record of claims and assertions, security and privacy, and other technical aspects), types of appropriate assignments,And ways web conferencing might be used in courses.

Web conferencing has been touted as a vital component of distance education courses. A wide variety of inexpensive and free software is available for facilitating a discussion of a group online. The question is, "what are we using it for?" What type of interactions do we promote with our questions and assignments. What type of problem solving and critical thinking do we require from our students online, and how successful are we? Software features might facilitate higher level discussions, but we believe achieving this is a pedagogical issue more than a technical one. Web conferencing offers the opportunity for engaging students in arguments where they critically analyze and synthesize information to support a position, present that argument to others and defend their conclusions. These are important skills for both our education students and their present and future students.

The Technical Side of Web Conferencing

The Internet provides a channel for one to one and one to many communication between humans with the computer as a mediating device (Collins 1996). Synchronously, chat rooms, MUDs, MOOs, telephony and videoconferencing provide the ability for widely dispersed users to converse concurrently. While this has immediate feedback and social advantages, it can also produce disjointed, superficial threads of conversation and put those with poor typing or reading skills at a distinct disadvantage. Asynchronous modes of communication such as email, listservs, newsgroups, groupware, and web conferencing allow widely dispersed users to converse in a time-independent, self-paced, reflective manner with or without a structure built into the conversation. While this, too, can become disjointed and dragged out, it allows the user to review the structure and content of discussions and more time to reflect and compose their response.

Bulletin boards, newsgroups, and listservs have been in use for these online discussions for years. More recently, centralized forums designed specifically for group discussions, such as Web Board, Hotwired, HyperNews, First Class and Ceilidh, assign each message a place in a discussion structure. Workgroup collaboration software, such as LotusNotes, takes this one step further by providing computer-based systems that support groups of people engaged in a common task in a shared environment. These systems allow for both interactive communication and document sharing. It is these last two categories of software that provide the capabilities needed to carry out argumentation in an online environment.

Skills in Argumentation

Students need skill in the process of argumentation to engage in critical thinking and persuasive writing, to understand and evaluate arguments in specific subject domains, to construct their own knowledge (Mason & Santi 1998) and to participate in socially constructed knowledge. Unfortunately, their arguments are often fallacious, based on invalid arguments, inadequate evidence, and representations of argument and evidence altered to accommodate naive argument structures and regression to core beliefs (Zeidler 1995).

Toulmin's six stage model of an argument includes claims, grounds, warrants, backing, qualifiers, and rebuttals (Toulmin et al 1979). To develop skill in using this model, students must have access to, and command over, the information resources and skills required to frame the research problem. They need to assess previous research and identify key issues, synthesize ideas and articulate their own hypothesis or claim. To support their claim or proposition, they need to gather evidence, identifying and evaluating sources, making observations and gathering, processing and evaluating data. This gathering of evidence may require a wide range of specific kinds of resources, expertise and software, depending on the domain of argument (Foote 1994).

Skill in identifying and communicating warrants and backing that support claims requires an understanding of the issues and the ability to reason with evidence. It needs articulate and convincing connections that may require databases, maps, graphs, charts, tables, (Foote 1994) video and sound as well as print. Analysis of expert versus student arguments shows students are weak in developing reasoning to connect their evidence to a claim through warrants and backing (Crammond 1998). At advanced levels, they need an understanding of both context and audience to use the expert's communication strategy of an implicit rather than explicit warrant. They need to be able to identify the most effective foundation for argumentative appeal and use reason, ethics and emotion (Paradigm) as well as specific skills, tools and multimedia resources to communicate in ways that support these approaches.

As students modulate an argument with qualifiers and rebuttals, they need to be able to access, evaluate and analyze a wide range of related information (Foote 1994). This is especially so if they are to anticipate opposition and exercise the more sophisticated countered-rebuttal strategies of expert argumentation. Inferential reasoning and powerful communication of qualifiers and countered-rebuttals of evidence and warrants demands facility with databases, simulations and statistics. In this process, skill in constructing and communicating probabilistic arguments is essential (Leeman 1987) and requires access to and command of such tools as statistical analysis and graphic expression.

Assignments Requiring Argumentation

To develop, evaluate, accept or refute arguments, students at all levels need experience in identifying, gathering, evaluating, organizing and presenting evidence to support claims. Traditionally, that has been done in the context of papers, oral reports, and debates. Students are asked to support their arguments before teachers and fellow students with, however, limited opportunity for critique and refutation. They learn to create a claim, gather evidence (factual or opinion), and test the reliability and validity of the evidence. As emerging technologies offer new forums for distributed learning, there is the very real concern that the context will impoverish pedagogy and diminish the quality of learning. We propose that they can do just the opposite when use is thoughtfully structured. Pedagogical methodologies for engaging students in argumentation online are needed on top of the simple technical capacity for carrying on asynchronous conversations.

The type of assignment influences the type of argumentation structure used by students. They might be asked to defend or refute a position, present pros and cons of a position, critically evaluate one or more sides of an issue, support and/or develop their own position, reach a new position, solve an existing problem, make a decision, or persuade (Voss & Means 1991). No matter what type of assignment, the student needs to understand the rules, timeline and structure required.

Debate often refers to competitive oral debate with precise rules where students alternate to defend opposite points of view. They operate in a formal structure with points for style, arrangement and delivery of a position within specified time limits. This could be done by individuals debating before the rest of the class or by groups of students taking different sides. Judging by peers or outsiders could be set up in electronic format by asking the judges to submit an electronic ballot to each side at the end as a web conferencing message. The linear order of presentation could structure the debate as in the email debate between fourth and fifth graders on the right of US citizens to protest in time of war (Clark 1992) or it could be set up so that each side could go back and view past statements or examine a claim and its refutation side by side in windows. Related points could be linked within a web conferencing program so readers could see relationships between ideas. Ideally, a web conferencing program would allow hyperlinking or linking to specific sections within a message for greater ease of connecting threads of the debate.

Students required to take both sides of an issue can be encouraged to "see" an opponent's point of view. As students investigate, they generally "discover differences of reasoned, rational opinion on both sides" (Leeman 1987). This type of assignment forces students to confront confusion in the research, become part of the decision-making process and avoid viewing only one side of an issue. In debates conducted via web conferencing, students can easily link to "experts" on a side of the argument, and the opposition can examine the authority or bias of the evidence. Intellectually, such assignments give students experience in the multiplistic and relativistic perceptions of issues sought in Perry's model of intellectual development (Battaglini & Schenkat 1987).

Mimicking a real conference, web conferencing could be used for presentations with a discussant and questions from the audience or an online symposium or panel discussion. The discussant could tie together different presentations, point out similarities and differences, add their own knowledge, or critique the presentations.

In a role play, students are given a specific character role, asked to research that role's position, and present that perspective in an argument. There may be multiple roles in support of a point of view, each with its own perspective. This type of assignment is less structured than a debate, but could develop the same skills. The group could work for consensus or have a panel or body making a decision based on the arguments made.

This role playing could be part of a case study based on a real, relevant situation "complex enough to warrant analysis" (Seaman & Fellenz 1989, 111). Background for the case study could be available electronically to support real-world research and data gathering. Students could go beyond the classroom to contact experts, perhaps even inviting them to join the web conference to provide testimonials or evidence. Others might interview these experts through the web conferencing. The experts might even provide feedback to the group's decisions.

In a jury trial, students may take various prosecution or defense roles, act at judge or jury, or provide testimony as a witness based on research. Teams of lawyers could work together to develop questions for witnesses and provide opening and summary statements. The jury could continue deliberations through web conferencing without the input the lawyers. In a web environment, real lawyers and real judges could be asked to participate. The judge could be called on to moderate throughout. All this could be examined after the fact through the web conference transcripts. Committee hearings could be conducted the same way.

Any of these assignments could be enriched by examination of the transcripts either by participants after the conference is concluded or by other students during the conference. Such conversations remain on the web for an indefinite period of time in the same order they were created. Comments can be appended to any message for clarification, questions, or comment. New messages or specific types of messages can be flagged by different types of icons in some web conferencing programs. Readers can be lead to new, unread messages by date, special icons, or sorting. Some even allow email notification if a new message appears on the conference. Moderators might be asked to pull together comments on a topic or students might be asked to critique the argument from a particular perspective, or explain how they agree or disagree. Students might even be asked to reflect back on changes in their thinking through the discussion.

Web Conferencing Features

To construct and communicate argumentation online, students need to understand both the elements of an argument and methods for developing, communicating and supporting their argument in a web conferencing structure. As the basis of any argument, one must understand the opponent, the audience and the context. "Arguments respond to specific situations: a need is not being met, a person is being treated unfairly, an important concept is misunderstood, an outdated policy needs to be reexamined." (Guilford 1996). Understanding the adversary, audience and context in an online environment may involve formal research, informal, unstructured discussions, electronic introductions, or even online surveys concerning the area of interest. It involves the same basic type of research used in a written or oral presentation, but the information might be accessible in different, often multiple, formats.

Many of the new web conferencing tools offer a forum for creation and support of a logical argument across distances and time and strategies for attaching some kinds of evidence. Various features of web conferencing software can facilitate the argumentation process. Claims can be stated as a new thread or forum in a web conference with various forms of media used to supplement the text proposition and put it in context. Different audiences might be accommodated by providing hyperlinks to additional relevant information or more in depth levels of explanation.

As students develop hunches or good guesses into propositions and move beyond fact or opinion into statements open to debate in a web environment, they need the versatility to develop the scope of their argument in the context of web documents illustrated with multimedia. As they anticipate opposition, expand and communicate their argument, they need to have an environment that enables graphic portrayal of both sides with links to supporting evidence (Buckingham Shum et al 1996). Their audience needs similar mechanisms to contribute feedback.

Gathering, examining, and assessing the relevance and reliability of evidence from a variety of data sources, including observation and formal research can be done either electronically or in traditional formats. Using a variety of software tools, students can collate and organize data for presentation in a argument structure. If working as a group, they may choose to conduct their own private web discussion to select, relate, and organize appropriate grounds. For some, a concept map of related ideas might help in the organization of the argument. Ideally, a web conferencing tool would allow creation and online manipulation of a shared concept map. This same graphical organizer might be used to present the argument and lead the reader through a web of hyperlinked information. Andrews (1993), in a study of 150 Year 8 students, found that planning for argumentation tends to go before writing & most plans were in the form of spider diagrams, numbered notes, or connected boxes. Only 2% of those in his sample took the polar form (e.g., the for-and-against model). This differs from writing narrative, where the students planned during the act of composing. Groups need a way to collaboratively plan arguments across distances in this graphical format.

At the same time, both the small collaborative groups and the larger discussion may require a moderator to keep the group on task, move around mislinked messages, and make connections that seem to have been missed. This might be accomplished by allowing administrator rights to a limited number of participants in a particular forum. Security and privacy of individuals may also be an issue in some discussions. There are web conferences where the participants use aliases rather than actual names to protect their privacy. Only the instructor knows the identify of each participant. Even the instructor may want to use an alias to avoid influencing the conversation with "authoritative" comments and questions.

Individuals or groups can strengthen their reasoning by adding specificity, qualifications, and elaborations to already stated reasons. This can be in the form of additional textual messages or links to graphical, auditory, spatial, or motion evidence. This multimedia evidence can provide a new perspective on a claim. Links to simulations or statistical models that the reader can actually test, allowing readers to modify existing spreadsheets or graphs, or providing connections to experts for further clarification or elaboration are all possible through web conferencing programs. This is true hypermedia, which may incorporate text, images, maps, motion video, and sound linked electronically through multiple routes.

Reasoning from the evidence, or developing the warrant with backing, requires close examination of the evidence for patterns and relationships, reasoning and analysis, and inference. One of the most difficult things to do in a web conference is to make this warrant evident in a series of connected messages. Other readers may insert comments or questions in the thread of the argument, questioning the warrant or adding opposing viewpoints, depending on the rules of the assignment. An overall outline or graphical portrayal of the parts of the argument would make it easier to see the structure of the warrant and its backing.

Some web conferencing programs allow for the collapse and expansion of the outline of the message thread so that only the top level of the conversation is visible. With appropriately chosen subject headings, this might be used to point out the major evidence. If there were a way to indicate the types of links between these messages, it might facilitate making the warrant. For example, on concept maps, it is often possible to label the links between the nodes, indicating types of relationships. In some web conferencing programs, it is possible to add an icon to each message indicating the type of message, but indicating the type of relationship between messages is generally not possible other than indicating hierarchical relationships.

The structure of the online argument may vary in different web conferencing programs. In some a hierarchical structure is created, in others a linear structure. HyperNews is one program that actually creates both with an outline and inline mode, accommodating both structures. The hierarchical mode allows threading a conversation with each response connected directly to its referent. Many readers prefer a more linear structure as that is how most oral and written communication takes place. Developing and following a hierarchically arranged conversation requires a different type of cognitive organization. One must keep in mind the overall structure of the discussion to place each message in its appropriate context. Highly skilled reasoners tend to reason hierarchically by placing reasons in category form (Voss & Means 1991). With time to reflect on the development of their argument, this should be fairly simple. Use of the ability to view only high level messages would allow this organization to stand out as a type of advanced organizer.

Careful sequencing of an argument requires thought. Analysis of an argument is easier if there is a record of the structure of the argument and associated evidence for concurrent, and subsequent, evaluation and scrutiny. Refutation and response to refutation is more likely if there is opportunity for a delayed response that permits evaluation of evidence, reflection and consultation.

As the students anticipate their opposition, it is possible to link these qualifiers and rebuttals directly to the points they wish to question or refute. This can be done easily in a hierarchical structure. In some programs it is possible to add an icon indicating that the response is a question or disagreement with the previous statement. In the style of a pros and cons chart, students might want to create a matrix of points and counter points viewed side by side, possible if a program allowed parallel threads to be displayed in adjacent windows. Again, a concept map or other graphical portrayal of both sides would allow hyperlinking between related points. With the ability to link out to other sources on the web, experts or their writing could also be brought in to present contradictory evidence, question the accuracy of evidence presented or draw attention to a fallacy of reasoning.

Navigation in web conferences may allow the reader to search for specific points or terms within the messages or the subject headings, jump out to related evidence in a variety of formats, search for additional information on the issue, follow a chain of reasoning set up by the arguer, examine specific types of messages, or view only related messages on a specific point. The students creating the argument can link relevant points together through the placement of the messages, tie evidence together to support a claim through inductive or deductive reasoning through a hierarchical structure, indicate relationships between linked messages through subject headings or icons, add refutation to any opponent's point, and highlight new information through the program's dating or icon system.

Transcripts of these conversations are constantly available to anyone participating in the conference. This allows an individual or group to carefully examine the opposing points of view and critique their own evidence and reasoning. At the end of the discussion, individuals can look back to assess the strength and validity of the reasoning and evidence, their own contribution, changes in their thinking, and their skill in argumentation. Instructor can similarly use these transcripts to gauge student understanding and skill. These discussions can be archived for comparison to subsequent discussions, either by the same group or by a later class.

New forms of community and collaboration are possible in online discourse. The impediment of authority structures can change; students and teachers can become part of an academic discourse where everyone has an equal say. All students have the opportunity to structure and present their thoughts to the group as well as to examine and question the work of others. The roles of both students and teachers can change. Students can become both publishers and critics. They may be asked to do more than simply present a summary of their findings, and instead defend their claim or thesis to others. Their peers may be asked to do more than simply listen and add a few polite comments, and instead be prepared to act as discussants. Teachers can act as leaders, facilitators, moderators, or observers. The community evaluating the argument can expand; outsiders may join the discussion as experts, mentors, or critics.

For online discussion to support argumentation, students must understand how to create an argument, and respond to critiques or refutations of their work. Equally, as listeners, readers or responders, they must be prepared to evaluate the claims and evidence of others. Regardless of the discipline, instructors must structure assignments to require arguments, encourage participation, and move students toward critical thinking. Equally, the technologies used must also support an accessible, free-flowing and coherent discussion.

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Real-Time Collaboration over the Internet: What Actually Works?

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Abstract: While the growth of the Internet and collaborative software has greatly impacted the way students work together, little is known about what actually works and what doesn't. Some researchers argue that both structural and cultural problems impact effectiveness, while others suggest that a lack of "critical mass" may be affecting the results. This paper suggests that all of these things are true. In also contends that the type of task required of the group and collaborative style influences effective real-time collaboration. While this paper confirms that collaborative interfaces help most people work more effectively, it also shows that some groups are less successful, have fewer interactions, and remain hostile towards the system even though they complete the required task. More importantly, the results of our research raise additional questions about how technology can support distributed groups, and what is the nature of the mismatches.

Introduction

As the number of distance learning and online courses continues to increase, we are being forced to re-examine the way we teach students to think. The idea of the "classroom teacher" is gradually being replaced by a web page or "talking head" that emanates from a remote site. Because of the rapid growth of this type of technology, we are beginning to question whether technology can support the in-depth contact between subject-matter expert and a small group of learners that is at the heart of our nation's peerless reputation in higher education. While both the Internet and other types of distance learning systems provide interesting pedagogical experiences, they lack many of the features that are associated with traditional educational classrooms such as laboratory exercises and small group discussions. If one of our goals is to improve education (Willis 1993), then we need find ways to provide teachers and students with electronic learning environments that support both mentoring and collaboration through electronic means.

In order to address this challenge, the authors developed special software that supports same time/different place educational collaborative activities over the Internet. These activities focus on teaching students how to organize and systematize their explorations for information and to share this information with members of a group. The software is composed of a unique interface that connects to the hyperlink, text, graphics, video and sound capabilities of a browser to a World Wide Web (WWW) client-server environment, and is augmented by local electronic help tools and computer supported collaborative tools. Collaborative activities are supported through specially designed whiteboard, chat, file and application sharing tools. Students can access online schedules and determine whether faculty or other students are available. The system is also equipped with both management and record keeping capabilities that allow teachers or trainers to analyze the various collaborative activities. Over 200 students enrolled in a variety of different courses at the University of North Texas used the system during the past year to collaborate with both students and teachers throughout the campus and different parts of the Metroplex. Information was logged concerning overall student performance, activities performed while using

the collaborative system, and attitudes related to technology and collaboration. Results from these history files were then analyzed to determine which factors contributed to successful/unsuccessful collaboration.

While the past year's research show that collaborative interfaces help most groups work effectively, it also shows that some groups are less successful, perform fewer group interactions as compared to successful groups, or are uncomfortable with the system even after several hours of training. For example, we observed that some individuals completed the stated task but never shared information with other members of the group. Other subjects were disruptive, eventually causing the group to fail. In contrast, there were groups who learned how to complete tasks successfully, even when faced with adverse network conditions. Although the results of this research show that most distributed groups produced work that was indistinguishable from groups doing the same work face-to-face, some groups' performed poorly, some had members who never participated, and some work teams complained about the system, even though they performed well. Thus, over the course of two years, the authors have discovered many factors that both encourage and deter collaboration among students. The nature of these factors and how they impact effectiveness are discussed below.

Relevant Literature

Much has already been accomplished in demonstrating the potential of using the Internet for educating, sharing, connecting, and communicating. For example, students enrolled in political science courses use the net to access large databases (Baker 1993; Newton 1993), students in high school use it to contact experts in the field (Press 1995), and students in business use it to learn about changing stock prices (Winner 1994). An ever increasing number of virtual classrooms are now available to students living in different cities or states (Huang 1997; Foster 1995). However, increasing educational opportunities have resulted in decreasing classroom time, and hence, decreasing the number of occasions where students and teachers interact with one another face-to-face. Thus, the question remains of how to make distance leaning environments support real-time educational activities such as academic advising, mentoring, laboratory experiments and small group exchanges (Reinhart 1995). While we know that network technology can be used to empower learners with the latest tools of the trade, we also know that it lacks the personal element that can give meaning to an educational experience. Thus, our prototypes and models must clearly demonstrate how network technology can evolve into an educational ecosystem of information, computation, communication, collaboration, and innovative mentoring. At the same time, the models must emphasize information access and visualization to provide easy derivation of an interactive information experience.

In response to these problems, the authors engaged in a number of innovative collaborative software projects sponsored by various funding agencies over the past several years (Swigger & Brazile 1995; Swigger et al., 1997). In order to enhance students' understanding of the cooperative process, we built several computer-supported cooperative interfaces that teach students how to cooperate more effectively in the accomplishment of specific tasks (e.g., library database searching, requirements elicitation, and cost center analysis). The cooperative interfaces all emphasize shared window systems (i.e., What You See Is What I See) that allow students who are geographically distanced from one another to work together at the same time. While several of the original interfaces proved effective, they did not support shared activities over the Internet. Thus, we developed an Internet-based tool that supports real-time collaborative learning over the network. The major focus of the research is on showing students and teachers how to work together over the Internet, and how to locate, synthesize, and analyze vast amounts of available

information. The long-term goal of the project, therefore, is to study what factors (in terms of both the interface and instructional materials) lead to effective collaborations. Thus, we are analyzing how teachers and students move from their specialized classrooms into shared, multi-user settings where diverse groups can collectively solve problems.

Collaborative Software

As previously mentioned, the project's major objectives are (1) to develop software that allows students to collaborate, and (2) to determine whether the software can be effective in an educational setting. Thus, the first task, to develop software, has resulted in a series of programs that allows students to access special tools, libraries, and the network, to pose questions and conduct exchanges with teachers and other students in real-time. As a consequence, the system supports students who are located in different geographical areas, but who need real-time (i.e., What You See Is What I See) access to information from a number of different sources, including a university, the Web, and local networks as well as other students and teachers. Students are free to perform activities, find information, conduct experiments, and engage in collaborative activities to obtain information. Since the system supports both synchronous and asynchronous communication, the collaborative activities can occur either at the same or different times.

The current application comes equipped with a number of collaborative capabilities that enable teachers and students located in different geographical locations to "enter" each other's worlds. For example, the system allows groups to share applications and perform a specific task such as completing an experiment, writing a paper, using a software package. Thus, the major software components include (1) a special graphical user interface, (2) support programs that manage the communications and data gathering functions, and (3) administrative programs that support activities such as student/group registration and report generation. The special graphical user interface consists of a shared Browser for the WWW, and a set of collaborative tools that permit groups to chat, use a whiteboard, and share both applications and files. The support programs that manage the communications and data gathering functions include a polling application that maintains the user and group lists, and a suite of programs that create, maintain, and update the database. Finally, the system performs administrative functions such as installation, student and group registration, and report writing.

Evaluation

As previously mentioned, a major component of this research is the evaluation of the effectiveness of the collaborative interface to determine what is and is not effective. During the past two years, over 400 students have used the collaborative software in seven different courses. Courses using the collaborative courses were compared to control courses using a pre-test post-test, matched controls design. The evaluation was designed to determine the effect of the collaborative technology on student learning outcomes, student attitudes, and attitudes about collaboration. Results from comparisons of just the performance variables (i.e., that course grades and scores on the questions concerning analysis and synthesis of information) indicate no significant difference between the control and experimental groups.

We also collected information from the computer sessions through our data collection programs. The system logs information such as source, time, and type of interaction. Thus, we were able to capture a detailed record of the types of activities that students (and groups) perform while using the interface. Analysis of this data indicates that group chat was the most frequently

used collaborative tool regardless of course content or activity. The shared web browser was the second most frequently used tool, while usage totals for all other tools corresponded to the type of task that was performed by a particular group. The system log information was also correlated with factors such as age, a student's major, and gender and indicated that these variables often impact a group's productivity (as measured by total time to complete a task and the activities performed during the task). For example, students enrolled in non-technical courses used the chat tool more frequently and longer than students enrolled in science course. Groups who were dissatisfied with the system did not necessarily perform less well than groups who were satisfied. And finally, as network delays increased, remote groups spent more time managing their work or verifying that a message had been either sent or received. Although our observations seem sound, they are based on a limited amount of data. In the next year, we will gather additional information about a group's work, learning, and communication style to determine their effect on distributed problem solving.

From both observation and data gathered during the project, a number of conclusions were made concerning how students used the interface and which parts were successful and unsuccessful. These conclusions are as follows:

1. Students seem unable to manage multi-tasking or multiple windows. As new applications are opened, existing windows or applications are hidden. Once removed, students mistakenly believe that the application has shut down and must be re-opened. This can reek havoc in a synchronous communication environment.

2. Students seem unable to distinguish between the different modes of a computer. For example, they fail to understand that there is a difference between "shared" and "individual" modes of work.

3. Students need to know how to map the computer-collaborative tools onto the specific tasks. (I.e., Which collaborative tool should be used for which task?).

4. Students become frustrated when they do not know what other members of the group are doing. As the students become more proficient with the software, they learn to use awareness tools that provide them with information about the other members of the group.

5. Students lack metaphors for shared software applications. As a result, they have no established protocol for how to interact with team members while using this type of software.

We also examined the various collaborative exercises used in this project to determine which factors contributed to success. Examples of these activities can be found on the project's web page (i.e., www.vcuproject.edu). The types of activities developed by different faculty tend to vary according to the nature of a particular discipline and the faculty member's particular style. However, based on both observation and data, we are able to make a number of conclusions about what types of tasks were most successful. For example, successful collaborative experiences tended to be both extremely focused and small. Initially, faculty members modeled their collaborative exercises after classroom exercises in which both groups and teacher are free to roam around the room. Unlike the classroom, however, a teacher cannot always sense when a group is frustrated or confused and must often wait until it is too late to correct the problem. As a result, many of the computer-supported collaborative activities were scaled down to accommodate the loss of visual cues. At the same time, the set of instructions provided to students were greatly increased and posted on both the faculty and course web pages.

We also found that it was not always possible to adapt a classroom group activity to a computer-supported collaborative environment. Tasks that worked well in the classroom did not always translate into the new environment. One such activity was an environmental science project that asked students to collect data on a number of different events and then share this data with other members of the group. Given the location of the data collection source (e.g., an outdoor pond), it was neither convenient nor possible for students to share their data in a machine-readable format. As a result, the collaborative software became more a hindrance than help in supporting collaboration.

Data on faculty satisfaction also tended to vary. Faculty were surprised that Internet communication was sometimes slow and inconsistent. While some faculty experienced no problems with the hardware or software, others were overwhelmed with the technology. Successful experiences with both software and student collaboration tended to occur when the faculty member was well organized, and the student activities were well structured, small, and self-contained. As the complexity of the educational activity increased, the level of unsatisfaction among both faculty and students also increased. Finally, our interviews with faculty that participated in this project clearly indicate that most do not realize that collaborative skills have not been mastered at an earlier age. However, our data suggests that most students lack both organizational and interaction skills and, as a result, often end up working alone to complete the task. For example, the most frequent statement recorded in or study's database was the question: "Ok, what do we do now?" This is then followed by a series of responses, all echoing the phrase, "I don't know." As a result, the training sessions included information about the use of the system and how to collaborate. For example, students were shown how to use the chat tool to establish their group's procedures and distribute the work. After such training, the collaborative exercises were much more successful.

Conclusions and Impact of Research

In conclusion, we believe that we have identified a number of factors that contribute to successful computer-supported collaboration. After developing a system that supports real-time collaboration for students in different locations, we examined how students enrolled in a number of different courses at the University of North Texas used the software to complete specific tasks. While our research shows that the collaborative system helps most groups work effectively, it also shows that some groups are less successful, perform at a slower rate than face-to-face groups, or are intimidated by the system even after several hours of training. Success with the system seems to be affected by task, training, and experience. Knowledge of how to perform as a leader also seems to be an important factor.

Furthermore, groups' preferences for and use of certain collaborative tools, as well as their use of features within those tools, greatly varies. However, judged by the total time spent completing the task and by their scores on a series of related questions, performance seems unaffected by whether distributed groups used all or some of the collaborative tools. Our studies also show that the collaborative interface allowed groups to brainstorm and co-author documents and, in doing so, encourages both talking and doing in the same meeting. On the other hand, because of the often-restrictive nature of the interface, groups are forced to talk to each other via their fingers rather than their mouths. As a consequence, team members with inadequate typing skills feel inhibited or restrained. In addition, we noticed that many students learned to adjust their communication style and adapt to the more delayed mode required by the chat tool.

In our research, we have found that while software allows groups to work more effectively, group performance is often impacted by a variety of individual personality, communication, and work style preferences. We have also observed that groups tend to react to individual preferences in a number of different ways. Some groups engage in additional procedural or management activities, while others perform fewer clarification or solution activities. It is our observation that the need for low cost, distributed education occurs frequently in this technological society. Yet rarely do we use network technology to actually meet these educational goals, nor do we provide students and teachers with the tools to communicate in this mode. As such, this research should provide insight and software tools for broad-based interactive learning by electronic means. Moreover, it provides a rich research environment that allows us to investigate various issues related to improving the performance of student and organizational teams that work together across distances.

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Web-based Instruction and Motivation: Some Useful Guidelines for Educators

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Abstract: The purpose of this paper is to point out the importance of motivation and describe a model that provides a useful framework for both the design and improvement of the motivational quality of Web-based instruction. This paper presents an overview of the primary components of motivation as well as a motivational instructional model. In addition, it discusses an instrument used for designing and assessing the motivational quality of World Wide Web sites.

Introduction

Web-based instruction is rapidly increasing in our educational system. More and more educators are utilizing the great potential of the World Wide Web, including the use of hypertext and hypermedia, in their teaching. As Web-based instruction continues to grow, the need for design guidelines also increases. Although there are some guidelines for the structure and content of Web-based instruction, very few address the motivational aspects. One of the important issues to consider when designing Web-based instruction is motivation.

Motivation is relevant to learning and must be included in any instruction. Most students only learn to pass their tests or meet the necessary guidelines to finish their degree. However, students who become both extrinsically and intrinsically motivated will continue learning even when formal education has ended. Moreover, motivating lessons will encourage students to become more curious as well as make learning experiences enjoyable. These aspects allow students to remain at a task longer until they master the skills and knowledge presented to them.

In order to improve the motivational quality of Web-based instruction rationally, there is a need to understand the components of motivation. Thus, the first part of the paper presents an overview of the primary components of motivation. Furthermore, a motivational instructional model that takes into consideration the motivational aspects of instruction is discussed. The last part of the paper describes an instrument used for designing and assessing the quality of World Wide Web sites.

Components of Motivation

The components of motivation presented in this paper are three cognitive theories: Rotter's social learning theory, Weiner's attribution theory, and Atkinson's expectancy x value theory. These motivational theories are discussed to help educators predict and influence students' behavior. Cognitive motivation theorists regard "cognition" or "beliefs" as mediators of behavior (Stipek, 1998). These theorists believe that changes in behavior are a result of change in individual cognition and belief. However, these cognitive theorists have different regards on the "beliefs" and "cognition" they emphasize.

In Rotter's social learning theory (1966) thoughts affect achievement behavior. Rotter proposed that an individual's belief about what brought the reward increases the frequency of behavior, not the reward itself (1966, 1975, and 1990). Rewards need to be associated on the individual's personal abilities or characteristics in order to have any influence on their behavior in the future.

Rotter refers to an individual's belief regarding the contingency of reinforcement as locus of control (LOC). "Internal locus of control" refers to the belief that an outcome is possible based on one's own behavior, such as ability or effort. Other factors that are beyond an individual's outcome such as luck

are considered "external locus of control." Rotter believes that it is very important for students to link their academic achievement with their locus of control. In order to work harder on tasks and progress in their studies, it is necessary that students attribute their success based on internal factors such as effort and ability rather than external factors such as luck For example, if rewards are the same for all students (everybody in class gets an "A"), students will not work hard because they feel that the rewards are not contingent on their behavior. Increased learning and future success will occur only if students believe that their own behavior has caused the reward.

Attribution theorists such as Weiner have refined and elaborated upon Rotter's concept of locus of control. Attribution theorists believe that humans are intrinsically motivated to understand the world around them, to "attain a cognitive mastery of the casual structure of the environment" (Kelly, 1967, p.193). Wiener also believes that individuals naturally want to know why events occur, especially when the outcome is important or unexpected. Perceptions of the cause of achievement outcomes are referred to as "casual attributions." Weiner, claimed that "the specific casual attributions are less important in determining achievement behavior than the underlying dimension of the attribution" (1979, 1985, 1986, 1992, 1994). In Weiner's attribution theory, the "casual attributions" are similar to Rotter's external-internal locus of control. However, Weiner-believes that internal-external locus of control does not completely justify the cognition process. He further distinguishes between different internal causes of achievement outcomes with regard to their stability and controllability. For Rotter ability and effort were internal factors and were treated the same. Weiner regards ability as a stable cause that cannot be controllable. However, effort is controllable and changes from one situation to another. Graham (1994) stated that the two dimension stability and control that Wiener has added to Rotter's original external and internal dimension allow much more specific behavioral predictions from beliefs about the cause of reinforcement.

For attribution theorists an individual's own interpretation of success or failure is very important. Weiner believes that an individual's interpretation influences how much the individual will try to achieve a behavior.

The goal in Atkinsson's value theory is to predict whether an individual would want to approach or to avoid an achievement task. Atkinson (1964) proposed that a motive, or need to achieve (Nach), directs individuals toward achievement tasks. Nach is a stable disposition that directs individuals to strive for success. Atkinson defines Nach as a "capacity to experience pride in accomplishment" (Atkinson, 1964, p.214). The motive to avoid failure (MAF) is the stable factor directing individuals away from achievement tasks. MAF is unconscious and is conceived as a capacity to experience shame given failure (Stipek, 1998, p.54).

Even though the motives to strive for success and to avoid failure are both unconscious, Atkinson also believed that individuals' behavior is also influenced by their conscious belief. The two conscious variables to approach tasks are: Perceived probability of success (Ps) and the expectations of pride which Atkinson refers to as the "Incentive value of success (Is). The other conscious variables to avoid tasks are probability of failure (Pf) and the anticipation of shame, which Atkinson refers to as the incentive value of failure (If). The resultant tendency to approach or avoid an achievement activity is called TA.
Thus, the expectancy x value theory is TA = (Ms*Ps*Is)-(MAF*Pf*If).

According to Atkinson's expectancy x value theory, "individuals who expect to succeed at a particular task are more likely to approach it than individuals who are less certain about their chance for success" (Stipek, 1998, p. 61). For example in this theory "effort" is identified as the major motivational outcome. For "effort" to occur, two necessary perquisites are specified. First it is very important for the individual to value a task. Also, the person must believe that he or she can succeed at a task. Thus, in instructional settings the tasks should be presented in a way that is meaningful to the student and promote positive expectations for successful achievement of behavior (Small, 1997).

It is possible to understand and predict at an abstract level the theories discussed above. However, it is very difficult to give "concrete, generalizable prescriptions for what will motivate any given audience or individual. There is too much variability in the attitudes, values and expectancies of learners (Keller, 1987, p. 1). One design model that takes into consideration the components of motivation and is based on a problem solving and heuristic approach is the ARCS Model of Motivational Design (Keller, 1983, 1987).

ARCS MODEL

ARCS is a research-based systematic design model that interfaces with typical instructional design and development models to improve the motivational appeal of instructional materials. In this model, the motivational components of instruction are embedded within the instructional design model (Main, 1993). The description of the model, which provides strategies that a course designer or teacher can use to make instruction responsive to the needs and interest of learners, includes four major conditions: Attention, Relevance, Confidence and Satisfaction. Keller in 1987 breaks each of the four ARCS components into three strategy sub-components for motivating instruction.

Attention strategies are for arousing and sustaining curiosity and interest. Moreover, the techniques should maintain and even increase the level of curiosity and interest throughout the learning experience. Attention strategies arouse and perplex students' thought processes and build inquiry and critical thinking skills (Curtis, 1992, p.32). Examples in Web-based instruction can be using multimedia and providing surprise or novelty at the beginning of instruction.

Relevance strategies link to learners' needs, interests, and motives. Relevance techniques help students link their own needs and styles to the instructional content and methods. Keller believes that it is very important to inform the learner of the importance of the learning outcome. Examples in Web-based instruction can be users-control, clearly stated objectives and comprehendible examples.

Confidence strategies help students develop a positive expectation for successful achievement. Confidence is related to how learners expect to succeed in an instruction. Keller states that personal expectancy for success is influenced by past experiences. Difficulty of tasks, locus of control and personal causation also contribute to confidence. Examples in Web-based instruction can be simple clear directions, readable font size, and hyperlinks to definition.

Satisfaction strategies provide extrinsic and intrinsic reinforcement for effort. Keller believes that satisfaction is derived from achieving performance goals. He assumes that the gratification of goal achievement is confounded to some degree by whether the evaluation of learning outcomes is externally based or made by the learner internally (Keller, 1983). Examples in Web-based instruction can be appropriate feedback, effective hyperlinks, and saving and printing options.

The sub-categories of the ARCS model is described on the table below.

Categories and sub-categories of the ARCS model

Attention		
	A.1. Perceptual Arousal:	To provide novelty, surprise, incongruity or uncertainty.
	A.2. Inquiry Arousal:	To stimulate curiosity by posing questions or problems.
	A.3. Variability:	To incorporate a range of methods and media to meet students' needs and to maintain their attention.
Relevance		
	R.1. Goal Orientation	To present objectives and useful purposes.
	R.2. Motive Matching	Match objectives to students needs and motives.
	R.3. Familiarity	Present content in ways that are understandable and related to learners' experience and values.
Confidence		
	C.1. Learning Requirements	Inform students about learning and performance requirements.

	C.2. Success Opportunities	Provide meaningful opportunities for successful learning.
	C.3. Personal Control	Link learning success to students' personal effort and ability.
Satisfaction		
	S.1. Natural Consequences	Encourage and support intrinsic enjoyment.
	S.2. Positive Consequences	Provide positive reinforcement and feedback.
	S.3. Equity	Maintain consistent standards and consequences.

Table 1: The categories and sub-categories of the ARCS model.

WebMAC Instrument

The Website Motivational Analysis Checklist (WebMAC) (Small, 1997) is an instrument used for designing and assessing the motivational quality of World Wide Web sites. This instrument is based on a number of theories including the ARCS Model of Motivational Design. The WebMAC provides an opportunity for structured analysis of the motivational quality of World Wide Web sites (Small, 1997).

The WebMAC has four general categories that are similar to the ARCS model. Web sites according to WebMAC should be Engaging (e.g. an eye catching title), Meaningful (e.g. stating the purpose of the Website), Organized (logical sequence of information) and Enjoyable (links to other Websites of interest). These categories are further divided into 60 items, 15 for each category.

The first version of the instrument was used in an assignment for a graduate-level class on "Motivational Aspects of Information Use" at Syracuse University in the spring of 1997. The WebMAC allows the designer to rate the motivational quality of Web-based instruction and draw a graph. The graph will help educators have a visual picture of strengths and weakness of their design for further improvement.

Conclusion

Motivating instruction will make learning experience appealing for learners. Moreover, this form of instruction will display students intellectual curiosity and develop lifelong learners who will become intellectually curious to continue learning even when formal education has ended.

Motivating instruction is important in any kind of instruction. However, because of the nature of web-based instruction, designing motivating lessons will become more critical. In order to design an appealing and motivating web-based instruction there is a need for educators to acquire knowledge of the components of motivation. Also, educators should implement a systematic motivational design model in their instruction. Formal knowledge of motivation and using a systematic motivational design model can be powerful tools in improving the motivational appeal of web-based instruction.

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THEORY

The Role of Skepticism in Preparing Teachers for the Implementation of Technology

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Abstract: Many educational professionals, including teachers, embrace the potential that computer technology has for learning and teaching. Many classroom teachers, however, do not share this enthusiasm. Some of these teachers are skeptics, and some are fearful...afraid of change. Understanding the differences between skepticism and the resistance to change is critical in teacher education and technology training. If we do not pay attention to the skeptics or address the concerns of fear of change, the benefits of technology to education will be lost to inertia. Listening to the skeptics provide us insight into thoughtful consideration of the usefulness and purpose of instructional technologies. Listening to those resistant to change helps direct teacher educators to encourage risk-taking in pre-service and in-service teachers as well as helping teachers change their fear into healthy skepticism. Strategies are given for listening to the skeptics and for paying attention to the origins of technology resistance.

Introduction

Speaking to technology groups is like preaching to the choir. Everyone knows the message and believes in it. Speaking to and training teachers about technology is different; some of the audience already believes in the message, but the majority are both skeptical and fearful. In preparing this paper, I began to reflect on my own relationship with computers and the consequent mission of preparing other teachers to use this technology. When I was a 4th grade teacher in a small rural central Ohio school district, my principal approached some other teachers and me about attending a Radio Shack© training course for teachers. Although I was one of the more confused members of the training class, which by the way focused on teaching BASIC, there was something intriguing about those machines. When I saw examples of software that kept grades, tutored spelling, and simulated problem solving, I was hooked. Membership in the programming course dropped, but I hung in there and was rewarded by a new Apple IIe computer in my classroom. Soon I had my class grades automated, and I demonstrated the electronic grade book at parent conferences. The parents in that rural community were supportive of computer use; many saw it as a way to manage their farms. But I was disappointed in my colleagues' reactions. Fortunately I began to listen to their doubts and negative responses and wondered why they were so resistant to the technology by which I felt so empowered.

Even after a long journey through graduate school, industrial research, and current travels of college teaching, I struggle with a variety of emotions: the enthusiasm I have and see in others for the potential of computers in education as well as the confusion and respect I have for those who are reluctant to adopt computer technology for their classrooms. I have decided, however, that listening to the skeptics keeps the enthusiastic technophiles more honest to the task of making technology serve the education of our children, rather than having education serve the technology.

The Nature of Skepticism

Skepticism is the position that knowledge is limited and is denoted by a questioning attitude. The Spanish philosopher, Minguel de Unamuno, once said that, "The skeptic does not mean him who doubts, but

him who investigates or researches..." (Microsoft, 1995). Robert Frost's slant on skepticism is: "'Skepticism,' is that anything more than we used to mean when we said, 'Well, what have we here?' " (Microsoft).

What I first took to be unhealthy skepticism on the part of my colleagues proved to not be skepticism at all; what I was seeing was really fear and the inability to allow for new ideas. It is what George Kelly called "hardening of the categories" (Kelly, 1963). Kelly explains how we can effectively resist change to our beliefs. In technology training we witness both skepticism and hardening of the categories. Acknowledging both phenomena helps us understand how we should and could approach the training of teachers to use, and wisely use, technology. In serving pre-service and in-service teachers, there is a complex audience of early adopters, skeptics, and resistors (these same categories apply to teacher educators too, which is part of the problem). How do we address this complex audience?

The Nature of Teaching and the Pattern of Technology Adoption

The complexity of technology training for teachers can be partially explained in terms of three phenomena: the historical resistance of teachers to use media, the nature of teaching itself, and the life cycle of technological innovations. In his study of teachers and their use of media in their classrooms, Larry Cuban (1989) found that three factors influenced teachers' use of machines: (1) accessibility of hardware and software (is the equipment available and easy to use), (2) implementation of the innovation (is there administrative expectation and support), and (3) classroom and work settings (is the tool versatile and adaptable and does the setting accommodate the tool). Picture in your minds the successful technology using schools that you have seen . . . how many fit the criteria just mentioned? Picture the non-using schools and you will see the absence of these critical criteria.

The life cycle of innovations is fairly predictable and explains the cry of "fad" that we hear so much from educators. Innovations typically have a birth, used in light of a current idea, they die from lack of interest or innovative application, and then they are resurrected in a new form (DeBloois, 1982, p. 144). This life cycle entwines itself throughout the structure of society and education and causes fortunes to be made and lost, technology to be used and misused, and professors to be published by academic journals and scorned by practicing teachers. Drawing from his research, Cuban claims that teachers adopt a technology when that technology helps them do better what they are currently doing (Cuban, 1989, p. 66). This may seem appropriate but as a result they continue to use technology as an aid to teaching. They are consequently reinforcing the status quo. Teaching itself engenders a cautious attitude towards change (p. 60). Add to this cultural scenario a perception of video and film as entertainment and therefore to be suspicious as teaching tools (p. 61). Given the influx of computer games and simulations, one can see how computer technology can be suspect as a legitimate educational tool. Given additionally the historical and cultural resistance to change, how are we going to expand the potential that computer technology has for educating our children? This is not an easy task. Cuban says, "To question computer use in schools is to ask what schools are for, why teachers teach certain content, how they should teach, and how children learn" (p. 98).

Consequences of Not Listening to the Skeptics

As practical professionals, teachers are suspicious of new claims. Some of the fault lies with those who implement new ideas without proof of effectiveness and some fault lies with the technocists who invent the technology for shortsighted purposes or without seeking input from the people who will be using the technology. There is also the strong possibility of hubris developing among the technocists. Hubris is an exaggerated pride that usually leads to some form of retribution to the prideful. There can be such pride in a technological device, that purpose is limited only to what the machine does well, rather than to which human need it fulfills. Skepticism can be a form of conscience, which helps maintain a balance between the "must-do" people and the "wait a minute" people. Conscience is a steadying force in technological development. Thomas Green (1984) speaks of the role of conscience in a technological age. He says:

> There is thus a profound and tenuous balance that must be secured in our institutions. They must be maleable [sic] enough so the good and skillful persons who dream of what is not yet, but might be so, can be set free to decide and to act. But our institution must also be sufficiently resistent [sic]to change so that those whose conscience is merely technical and limited to skills of managing the political apparatus, but who are rootless in their souls, may not do irreparable harm.

What happens too if we convince teachers to use the technology and then not support with maintenance or training dollars? Millions of dollars are being spent on classroom technology, but if plans are not made to maintain and routinely replace technology, and help teachers use the technology, teachers will rightly complain that they were, again, led down a dead-end faddish road.

The Invitation

So what does this mean for the technology training of teachers? Here are some concrete guidelines based upon what we know about the life of technology, teacher adoption of innovations, and the nature of teaching:

- Provide teachers with numerous opportunities for training and practice.
- Provide administrative support for training and for taking risks to try new approaches with technology.
- Acknowledge the professional concerns of the teacher and base implementation on evidence of what works.
- Acknowledge the teachers' need for practicality while encouraging risk-taking.
- Provide post-training follow-up
- Whenever possible, provide just-in-time support
- Have sound pedagogical reasons for investing in and implementing the technology.

If we want to change pedagogy we have to change a teacher's beliefs that he or she has practiced and seen practiced for a long time (Cuban, p. 109). If, as teacher educators, we want to change a belief system, we had better be grounded in scientific, practical and artful evidence that the change will serve the client. We also ought to consult those who work more directly with the children: the teachers. An anonymous quote is an excellent reminder of our interdependency: "None of us is as smart as all of us." "All of us" include teachers, teacher educators, Boards of Education, parents and all other aspects of the community. We all have a stake in the education of our children and their preparation to live productive lives in a democratic society. I invite us to be skeptics, to ask "what do we have here?" , to not be doubters but be collaborative investigators of the opportunities that technology provides us.

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Virtual Teams in the Classroom

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Computer-mediated cooperative work groups (virtual teams) have been used and studied for several years in corporate settings. This paper will discuss and describe the background of computer-mediated communication in the schools and the culture it creates because of its unique characteristics. The advantages and disadvantages of virtual teams will be outlined and illustrated with real-life classroom examples. The second part of the paper will discuss using virtual teams in a learning environment. Several questions will be addressed, such as: What is the best way to structure the teams? How should the team and the communication be monitored and encouraged? How should the team work out difficulties that are encountered? What types of projects and activities work the best? How should the team and the outcome be assessed? Hopefully, this paper will cause teachers and teacher educators to consider the use of virtual teams in their classroom projects.

This paper, through literature review, examines social and behavioral issues and norms of computer-supported cooperative work (CSCW) in K-12 classrooms. The main body of research on CSCW has been growing steadily since 1984 when Irene Greif and Paul Cashman first used the term (Bannon 1992; Woodcock 1997). The two computer scientists organized a workshop to address issues about computers and people in the workplace, and they coined the phrase computer-supported cooperative work. The field of study has grown steadily since then. However, most research has examined CSCW in the workplace, and little is understood about the use of CSCW in classrooms (Fishman, 1997), including whether conclusions about CSCW in the workplace can logically be extended to CSCW in the K-12 classroom.

THE NATURE AND ADVANTAGES OF COMPUTER-MEDIATED COMMUNICATION AND WORKGROUPS

Research has established that "CMC [computer-mediated communication] produces much different affective and relational patterns than do other types of communication," because fewer and different cues are available to participants (Walther & Burgoon as cited in Lane 1994). That view has been borne out by other studies (Bordia 1997, Grenier & Metes 1995, Lipnack and Stamps 1997, Musthaler 1997). In

addition, Scharlotte and Christ (cited by Lane, 1994) said that CMC can facilitate the formation of relationships, help people overcome shyness, inhibitions, and physical handicaps that may make face-to-face situations difficult. Drawing on the foundation of those previous researchers, Lane examined CMC in the context of social interaction and developing interpersonal relationships among college students at the University of Oklahoma. The students' electronic postings resulted in a fairly exhaustive list of attributes that Lane suggests are primary advantages of CMC, which included 1) enhanced flow of information and creativity; 2) enhanced and new interaction patterns; 3) elimination of stereotypical communication barriers because of neutrality, anonymity; 4) increased communication; timely and accessible information and ideas; 5) expanded communication (beyond the classroom); and 5) fun, exciting, and challenging communication.

Again, these are not new revelations to those who have studied CMC in the business workplace over the last decade. In fact, Gordin, Gomez, Pea, and Fishman (1996) describe "increasing levels of interaction" in school learning communities using the World Wide Web (the Web) as those wherein students access published work; access tools and raw data; engage in written and oral dialogue with community members; perform in joint coordinated activities with work-based learning communities, and; incorporate their class work into published archives of a community's work.

Ryan (1992) believes that with the emergence of computer-mediated communication, people have discovered CMC as a means of connecting with peers, colleagues, and family. "CMC and the presence of international CMC networks provide a collaborative environment in which people can bridge the cultural and national differences that separate them"(Ryan, 1992). Thus in CMC, people all around the world can share and exchange their values, language, and icons without barriers. Even more, they start to construct their own unique ways of communication through this new medium. Gradually, with the participants' experiences and interactions in CMC, a new culture has been created unconsciously. Just like Howard Rheingold says in his book *The Virtual Community* (1993), "Most people who get their news from conventional media have been unaware of the widely varied assortment of new cultures that have evolved in the world's computer networks over the past ten years." Rheingold goes on to define "virtual communities as groups of people linked not by geography but by their participation in computer networks. They share many of the characteristics of people in ordinary communities, yet they have no face-to-face contact, are not bound by the constraints of time or place, and use computers to communicate with one another." (Rheingold, 1993, chap5)

DISADVANTAGES OF COMPUTER-MEDIATED COMMUNICATION AND WORKGROUPS

Some of the negative effects of extensive use of computer-mediated communication in the classroom are that students will perceive their world differently and thereby acquire some incorrect ideas about reality and ineffective thinking strategies. Doubters of technology hold two main concerns about very young children and computers. Their first concern is that time spent in front of a computer robs a child of the necessary development of the all five senses. The computer's one-dimensional characteristic does not let a child experience everything. Doubters of computers for very young children also fear that the computer does not give a student the broad base in learning that the physical world gives (Oppenheimer 1998). In the book *Silicon Snake Oil*, Clifford Stoll warns that anyone who is directed away from social interaction might become socially maladjusted and that the real sensations of true-life experiences can never be replaced by technology.

Some of the biggest disadvantages of computer mediated communication extend to the classroom teacher. These disadvantages are usually in the area of time and training. In an interview with David Dwyer (Salpeter 1998), the vice president of advanced learning technologies at Computer Curriculum Corporation and previous director of the Apple Classrooms of Tomorrow research program, Mr. Dwyer explained that teachers usually go through four stages when it comes to integrating computers into their classrooms. Each stage is about one year. Because teachers are the main instruments of the diffusion of computers in the classrooms the training for teachers must be extensive.

ADDRESSING THE ISSUES

What is the purpose of the team and how should it be structured?
Determining objectives for learning outcomes in virtual teams is much like traditional learning activities. Any relevant, purposeful learning objective can be used to guide learning in a virtual environment. The major consideration is determining how collaboration through CMC will be used to achieve the objective. In addition to print based resources, computer oriented resources will be added to enhance the learning process. Additionally, similar to planning activities for traditional learning activities, alternative activities to accomplish or support the objective should be available in the event of equipment problems.

Consideration must be given to the architecture of the available technology when determining the structure of a workgroup. An intranet (computer connections within a building or district) will allow creating workgroups with local students or classes. However, workgroups can be created without either configuration. Stand alone computers with, at a minimum, word processing and reference software can be used to create workgroups in a localized area. On the other hand, an Internet connection (requires service provider) will allow participation in workgroups with students and experts around the world.

What types of projects and activities will work the best?
Project selection should be determined based on the content area. Ideas for creating computer-based projects, collaborating with an established work group, and teacher resources are available on several web sites and in printed media. *Teachers in Cyberspace* (Meyers & McIsaac 1996) covers basic technical information and contains a disk with project ideas. Web resources created by educational organizations, universities, software manufactures, and teachers are steadily growing. The National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF) have created several CMC based projects.

In the experience gained through our experimental CMC localized workgroup, the distance factor may play an important role in the selection process of the project. Heterogeneous partnering, student's skill level, availability of expert consultants, as well as functioning equipment will increase the likelihood of success.

How should the team and the communication be monitored and encouraged?
The responsibility for monitoring student progress and the encouragement of participation in academic activities is the ultimate responsibility of the teacher. However, since students will be involved in small group or independent computer related activities, sharing responsibility of monitoring with students should be considered. Each student should keep a journal of interactions and results that could be turned in weekly to the teacher or the group leader.

How should the team work out difficulties that are encountered?
Guidelines and rules for the workgroup should be determined before the activity is initiated. Students should have the primary responsibility for creating the rules and consequences for expected behavior. These expected on-line behaviors, as well as methods for reporting and resolving common problems, should be clearly stated and available to all students and should be kept in the journal notebook.

How should the team and the outcome be assessed?
Objectives for the team should be developed concurrently with learning objectives. The type of project, level of the students, and process versus product will guide the development of an appropriate assessment tool. Checklists for specific workgroup behavioral outcomes may be appropriate if the objective is to increase skills in collaborative teamwork. On the other hand if the objective specifies a completed project, guidelines for evaluating the content, composition, and clarity of the final product should be used for assessment.

CONCLUSIONS
A single attempt at using CMC workgroups as a learning tool should not determine their usefulness. Problems and mistakes encountered in the initial attempt should serve as guidelines for improving the next activity. Hopefully, teaches will examine the benefits of CMC workgroups and begin to integrate them into the curriculum.

In addition to the implicit and broad-based learning applications available through virtual teams in K-12 classrooms, the structure and administration of such cooperative projects can help teachers and students succeed in achieving educational competencies. This includes the competencies established for educators in the State of Texas--the Technology Education Essential Knowledge and Skills Standards (TEKS), developed and approved by the Texas Education Agency in 1997.

The technology naysayers may warn that too much computer use stifles creativity, socialization, and teamwork. However, technology proponents say that just the opposite is true and that computer use in schools draws participation from students who are less outgoing or withdrawn during traditional classroom activities. Besides, the use of technology is just another tool, another means to reach and teach the students. The anti-technology stance argues against the expense, the learning curve, and the disruption of a changing pedagogy, whereas the pro-technology stance argues the need to change with the times to produce a competent, skilled workforce for the future. An argument against the growing use of technology in classrooms is that teachers don't have the time to learn it; however, in the corporate world self-learning and lifetime learning are trends that employees are finding they must embrace to remain viable and current in the workforce.

That is not to say that the sole responsibility should lie with the teachers. Increasingly, state and federal government agencies are supporting technology in schools with some grants and mandated telecommunications rate reductions for schools. But Baker and Buller (1995), and others, acknowledge that cost and administrative support remain major barriers. "This is not an easy task when administrators do not understand the benefits, teachers might not have the knowledge to make it work, and school boards will not find the money."

Mandinach and Kline (1994) echo those sentiments, and suggest a model for a computer-based curriculum. Their work documents a then six-year effort to introduce computer-based curriculum to middle- and high-school students, and says that "[a] decade is not an unreasonable time frame for this type of endeavor." Success of the Madinach and Kline model relies upon several factors, including (1) computer hardware and software in a suitable setting; (2) support resources (e.g. stipends) for teachers learning the technology; (3) teacher release time and use of paraprofessional staff; (4) initial and continuing teacher training; (5) access to subject-matter experts; (6) technical assistance, and; (7) administration support and commitment.

Whereas Mandinach and Kline present a weighty technical documentation of their experience and model, Harris' 1998 work takes a lighter tone based on the analogy of building a house. In addition, teachers increasingly are documenting and presenting their experiences at various conferences, including those of information science and computer professionals. This is to say that resources exist that suggest methods to integrate technology into K-12 classrooms. However, the wired classroom is still a new venture. It is an evolving process as all facets of society struggle to learn and adapt to this medium, which is ever changing. The challenges are to overcome the resistance and barriers, to find the balanced middle ground of technological/fine arts curriculum, and to move forward with and into the information age.

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Korzybski Revisited: General Semantics for the Information Age

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Abstract: Key notions in Alfred Korzybski's General Semantics are described. Similarities between the development of a non-Aristotelian language more appropriate for the moern (1933) world and the need for a language for hypermedia is then suggested.

Science and Sanity was first published in 1933. Subtitled: *An Introduction to Non-Aristotelian Systems and General Semantics*, it was Alfred Korzybski's attempt at formulating a system "based on a rejection of [the aristotelian notion of] identity and its derivatives" (Korzybski 1958) which would be structurally more similar than the empirical world than its predecessor. To Korzybski, the prevailing logic and language(s) of the twentieth century embodied a pre-scientific worldview that was fallacious and misleading. "*Structure*," he asserts (Korzybski 1958), "*and structure alone,* is *the* only link between languages and the empirical world." The claim that he makes for this newer, non-elementalistic, system is a closer similarity of structure to the undifferentiated world of experience (circa 1933).

It is beyond the scope of this paper to go into the full development of Korzybski's General Semantics or the extensions which have continued to be developed since 1933. The purpose of this paper is to examine several of Korzybski's notions of structure as they relate to the language of "hypermediated" communication.

To lay a foundation for considering the non-Aristotelian (null-*A*) system as appropriate to this task, a representation of Korzybski's model of the "Structural Differentiation" is presented (Fig. 1) and discussed.

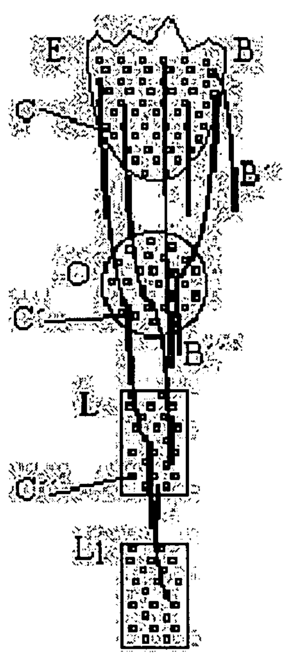

Figure 1: The Structural Differential

The broken parabola (E) at the top of the figure represents an event in the world, the small circles (C) indicate characteristics of the event. The parabola extends indefinitely as indicated by the broken edge (B) and the number of characteristics is, in reality, infinitely great. The circle (O) below the event represents the object with its characteristics likewise indicated by small circles (C′) which may be a large number, but finite. By naming the object, we ascribe to it a label (L) which will have even fewer characteristics (C′′).

Lines not connected (B′, B′′) indicate characteristics ignored or not abstracted from the previous level. The level of this first level may be considered as a descriptive level or a statement about the object. Subsequent labels (L_1, L_2, … L_n) are statements about the previous level's statement. The descriptive statement is an abstraction of the first order, the statement about it (L_1) of the second order, and so forth.

The event as depicted in the model (Fig. 1) exists in space-time, as must all events in the physical reality of post-Newtonian physics, which contributes to the infinity of characteristics. The object is abstracted at a moment of an ongoing process of tendencies and probabilities. The orders of abstraction underlie one of Korzybski's fundamental concepts, the multiordinality (m.o) of terms. The main characteristic of m.o terms is that at different levels or orders of abstraction they may have different meanings, meanings that are context bound and which establish their order of abstraction.

As Korzybski points out repeatedly, the map is not the territory. A good map, however, is one whose structure is similar to the territory that it represents. So, too, with language, the word can never be the thing it describes, but a language with structural similarity to what is being described is most useful. An Aristotelian subject-predicate language treats objects in isolation and not as members of collections having relations, order, etc. "Only a language that originates in the analysis of collections," claims Korzybski (1958) would have a similar structure to the world around us." Much of his book is spent providing the proofs that the structure of the null-*A* system provides a language of similar structure to the four-dimensional empirical reality posited by Einstein and Minkowski where time and space cannot be separated. The new language considers "the facts of the world as a series of *interrelated ordered events*…." (Korzybski 1958)

In Korybski's system several devices are employed to acknowledge a consciousness of multiordinality of terms and levels of abstraction. One such device was the use of *et cetera* to indicate that whatever was said descriptively about anything, there were always characteristics left unstated. Indeed, the use of 'etc.' is so prevalent in the work that he provides special null-*A* punctuation as shown in Table 1.

Abbreviation	Stands for	Abbreviation	Stands for
.,	etc.,	.:	etc.:
,.	, etc.	.?	etc.?
.;	etc.;	.!	etc.!

Table 1

Much has changed in the world in the half century since *Science and Sanity* was first published. The null-*A* system was created to fulfill a need for a language, i.e., structure, that matched reality (1933) to replace a structure that had not changed its logic since the Fourth Century B. C. There are, however, characteristics of reality (1999) that also share a structural similarity to the conditions that Korzybski was so concerned about. It is some of these characteristics that the rest of this paper addresses.

The empirical world as described above now contains an informational world with which it shares salient features. The union of space-time as a four-dimensional reality in the physical universe and the electronic information on a constantly changing network of networks of computers would seem one case in point. Not only has the "wiring" of the nation's schools, homes, and other institutions made electronic information access available to virtually anyone, it has also created, at a low level of abstraction, a structure similar to the reality of the modern physicist. The parallel exists between the situation Korzybski described that a changing view of the very nature of reality required a change in how people thought and spoke about it. It is no great leap to propose that traditional methods of teaching share the same difficulties in correspondence to the knowledge reality as classical logic had with a relational, ordered, and probabilistic reality. The growing use of Internet resources for information gathering by children and adults alike suggests the need for developing new structures. Perhaps there are clues to be found in General Semantics.

In 1933 technology, the new structure was confined to the linear form of speech and writing. Today we are looking at ready access to means of expression that can be as mutiordinal as the language used to describe, propose, or critique. The advent of hypermodal means of communication offers the potential of a communication medium that allows for numerous representations at any level which more closely resembles the reality that has been suggested here. The tools are available with computers and software for hypermodal creation. What is not currently present seems to be a well developed structure that we might call a language of this kind of communication. That was precisely the situation faced by Korzybski in his era.

In my graduate classes in teacher education, I teach teachers about using the technology to facilitate learning. Over the past few years that has centered on creating projects using Internet resources and on hypermedia creations using HyperStudio. One phenomenon I have observed is that novices to the hypermedia forms will typically begin their first project as a strictly linear structure, relying heavily on textual descriptions and explanations of subject matter. Their print orientation seems to govern the possibilities they can initially see for meaningful communication. The power, flexibility and complexity possible with these new tools would seem to elude, intimidate and frustrate the teachers, at least at first. There is a need for a new language that takes advantage of the new capabilities that technology offers us. Perhaps by looking to the past in Korzybski's efforts to create a more appropriate language circa 1933 we can find some guidance that will facilitate the creation of a new structure that will be usable and useful in the new century soon to come.

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Applying NASA Technology to Education, a Case Study Using Amphion

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Abstract: Amphion is a generic Knowledge Based Software Engineering (KBSE) system that targets scientific subroutine libraries. It was developed at NASA Ames' Computational Sciences Division. Amphion has proven useful for experts in the space science domain. One of the current challenges is to apply the system to different domains, educational settings, and the Internet. In order to assess the applicability of Amphion for educational settings, educators have been invited to try the system and to collaborate with the Amphion team. This paper describes the results of one such collaboration, which involved the development of educational web sites supported by Amphion-generated materials.

1. Introduction

The current implementation of Amphion (e.g. Amphion/NAIF) allows users to specify problems in the domain of solar system kinematics. These problems are specified using high-level terms that are relevant to the user, such as planet, ray, spacecraft, etc. The user-specified problems are then translated into programs that are composed of calls to the target library subroutines, in this case the FORTRAN libraries called SPICE developed by NASA JPL's NAIF group (see http://naif.jpl.nasa.gov/naif.html).

The translation is performed in two steps. First, a theorem prover, guided by a domain theory, solves the logical formula that represents the user-specified problem. The domain theory is a collection of rules and definitions that define how to convert a user-level formula into a low-level expression. Second, the resulting expression is converted by a translator into the final FORTRAN program. The execution of these programs may result in either an animation, or a calculation of specific pieces of information. The correctness of the resulting program, relative to the domain theory, is assured by the application of formal methods and artificial intelligence techniques. A description of the technical details can be found in (Lowry 1994).

Amphion (see http://ic-www.arc.nasa.gov/ic/projects/amphion/index.html) has proven useful for experts in the space science domain. One of the current challenges is to take the benefits of the system into different domains, to educational settings, and to the ever-growing audience of the Internet. In order to meet this challenge, a new version of Amphion, based on client-server technology has been recently developed. This new version allows access through WWW, supports different interfaces, and provides immediate execution of the programs generated by Amphion. A description of this architecture can be found in (Lazzeri 1998).

Different domain theories, such as computational fluid dynamics (CFD) are being developed for Amphion to operate on. Furthermore, in order to assess the applicability of Amphion for educational settings, educators have been invited to try the system. Dr. Jane Friedman was a NASA faculty fellow during the summers of `97 and `98. She is a faculty member in the mathematics and computer science department of the University of San Diego, with major teaching and research interests in mathematics education, particularly teacher training. Dr. Friedman worked with the Amphion group to develop materials for web based lessons on astronomy. This paper describes this collaborative experience and the web pages that were produced.

2. Motivation

There is quite a lot of excitement and even hype these days about the potential of the Internet and the World Wide Web to have a positive impact on education. There are an ever-increasing number of web sites which purport to be educational, and these vary greatly in quality and in their teacher-user friendliness. It is easy to create a web-site, but much harder to create one which will actually be useful to classroom teachers. As Cleborne Maddox notes "... the general state of the art in Web-based learning is in its infancy." (Maddox 1996). Another problem is how to best prepare prospective and practicing teachers to use the resources available on line effectively in their classrooms. New research is beginning to illuminate the substantial difficulties that exist in convincing teachers that the Web belongs in their classrooms, and then providing them with the necessary training (Wiesenmayer & Meadows 1997).

Thus there are two sides to the problem of how to ensure that the Internet realizes its potential as an educational tool, the problem of preparing appropriate Internet materials, and that of preparing teachers appropriately to use these materials. Both of these areas are poorly understood. Different kinds of expertise will be needed to create solutions to these problems, and this paper presents an example of the power of a synthesis between technological experts and educational experts. Amphion was developed by researchers at NASA for the use of other NASA scientists. It is not a toy program developed for the use of children, but a serious tool that has been used fruitfully by scientists. This can be a powerful motivating force for children. Even the most uneducated and deprived children can be turned on to space science. (See (Fierro 1997) for a moving account of the response of homeless Mexican children to presentations about Astronomy). It is exciting for children to know that they are working with the same tool that NASA scientists, real Astronomers, use in their work.

Amphion, as an educational tool, is under development. This means that the possibility exists of modifying Amphion in order to improve its usefulness to educators as well as to scientists. This is best accomplished by collaborative efforts between Amphion researchers, and educators including classroom teachers. The work described in this paper represents a first stage in developing such a collaboration. Each web page created was developed in response to published papers in educational journals. Thus, each is connected to work of educators and is responsive to their concerns. This is the power of such collaborative efforts.

3. Topic Selection

The Web is not necessarily the best teaching tool in all situations. There are many topics that may be taught just as well or better with books, other traditional teaching methods or manipulatives. The topics selected for use with Amphion, the causes of phases of heavenly bodies, and the causes of seasons, were ones which have proved resistant to teaching with traditional methods. Both topics are difficult for children and adults to understand. (See for example, (Atwood & Atwood 1996), (Kikas 1998), (Parker & Heywood 1998), (Sharp 1996)). In each case Amphion had a feature which could potentially aid in understanding.

The first web page developed was based on a paper by John Lamb (Lamb 1990), in which he posed the question of whether or not a crescent Mars could ever be seen from earth. In this paper he analyzed the problem geometrically and then presented a computer program which could be used to calculate the portion of Mars which would be seen at any given time. The difficulty in understanding the phases of Mars, or any heavenly body, is in understanding how the phases depend on the relative positions of the body viewed, the body from which the viewing is done and the sun. Using models and light bulbs can be helpful, but then the inaccuracies of scale can create misleading impressions. With Amphion we were able to create a pair of dynamically linked windows, which were displayed side by side to present animations that showed how the view of Mars from the Earth changes with the changing relative positions of the Earth, the Sun and Mars.

The causes of the seasons is difficult even for many prospective and practicing teachers to understand. (Atwood & Atwood 1997) showed that while physical models were completely effective in enabling prospective teachers to understand the causes of day and night, they were much less effective in helping these same teachers to understand the causes of the seasons. Atwood and Atwood suggest that the models might usefully be supplemented by a computer simulation. This again seemed a useful role for Amphion. The seasons are caused by the tilt of the Earth on its axis. The areas of the Earth which are tilted away from the Sun at any given time, receive less direct sunlight, and therefore less warming. Amphion was used to create an animation which displays the solar incidence angle as it changes with the changing seasons. This could be used to

supplement other teaching methods to help K-12 students and their current and future teachers understand this complex phenomenon. Curriculum in K-12 is guided by various levels of educational standards, which are used by teachers to look for relevant materials. The topics selected for this project are identified as important in the National Science Education Standards: http://www.nap.edu/readingroom/books/nses/html/.

4. Lesson 1: "The Phases of the Heavenly Bodies"

4.1 Original Explanation

(Lamb 1990) asks the question "Can a crescent Mars ever be seen from Earth?". He was primarily interested in the mathematics used in answering this question. A full half of Mars will always be illuminated by the Sun, but the portion of Mars which is seen from the Earth will depend on the relative positions of the Earth, the Sun, and Mars. Let SME be the angle between the Sun, Mars and the Earth, and let SEM be the angle between the Sun, Earth and Mars; then the portion of Mars which appears dark will be directly proportional to SME. The larger SME is, the larger the dark portion of Mars and the smaller the illuminated portion. If we were to see a crescent Mars, the dark portion would be most of the visible portion of the planet. We can find the maximum value of SME by using traditional methods of the calculus (differentiating an expression involving trigonometric functions).

Lamb's paper is aimed at college level teachers. Yet in the National Science Standards, changes in objects in the sky, in particular the phases of the moon, are mentioned even in the K-4 content standards. These young children could not possibly understand the mathematics involved in Lamb's paper, but they can understand some of the basic science. In particular they can understand that the phases are caused by the light of the Sun shining on the bodies and the effect of relative position on the appearance of the illuminated body.

4.2 Amphion's Explanation

Amphion can be used to supplement traditional teaching methods involving the use of light bulbs and physical models. Lamb suggests using a computer as a computational aid. We use Amphion as a computational and a visualization tool. We not only calculate angles, but we create two dynamically linked animations; one which shows the relative positions of the bodies and another that shows how the planet would appear viewed from earth.

One of the benefits of using Amphion for this explanation is that once a given animation is generated, it is very easy to get similar animations for other configurations. For example, it would be easy to modify the program to observe the phases of the moon as seen from Earth, or the phases of Pluto as seen from Neptune. This ability allows the student to make several observations to support the generalization of a concept. In fact, we have developed a template that allows the user to designate the observed planet, observing planet, and bright body for a given animation. This template is shown in (Fig. 1), which is a snapshot of the graphical editor, one of the specification editors that can be used to input problems for Amphion.

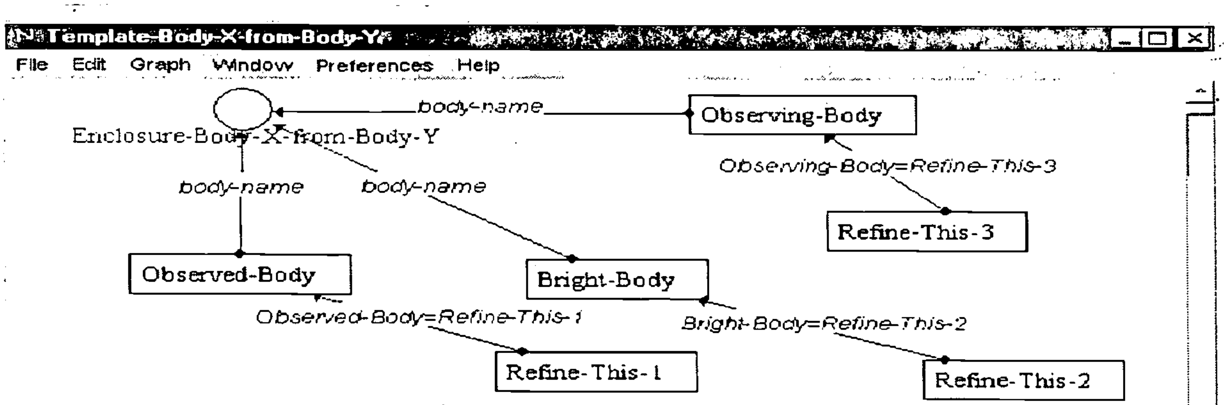

Figure 1: Sample Amphion Editor Screen.

All the user has to do is to replace the "refine-this-X" items by actual values and then to call the automated software engineering engine to produce an animation. Templates like the one in (Fig. 1) will allow students to easily create their own animations and formulate and solve their own problems, such as: As we move further away from the Earth, what happens to the maximum shadowed area of the planet as seen from Earth?

(Fig. 2) illustrates Amphion's generated view of Mars as seen from Earth. The left side of the figure shows a view of Mars as seen from Earth on the date 11/12/94 at the time 17:35:17. The right side of the figure displays the relative position of the planets on the same specific date and time. The planets are not drawn to scale in order to better illustrate the different phases of Mars, otherwise, Earth and Mars wouldn't be visible given the great size disparity as compared to the Sun. In that figure, the Sun is yellow, the Earth is cyan, and Mars is shaded so that it is possible to tell how much of its dark side is seen from Earth.

In a live animation, the positions of the planets in the right side change continuously, and the view of Mars from Earth in the left side change accordingly. Amphion generates automatically most of this image. However, the legends "Angle SME=40.9", and "Maximum shadowed area of Mars visible from Earth", as well as the lines that form the triangle and indicate the angles between the planets in the right side of the figure were manually added to enhance the expressive power of the picture for this particularly critical frame. Besides Amphion's generated materials, the web site for this lesson contains background information about this concept.

The URL for this lesson is http://ic-www.arc.nasa.gov/ic/projects/amphion/MARS-PHASES/phases.html.

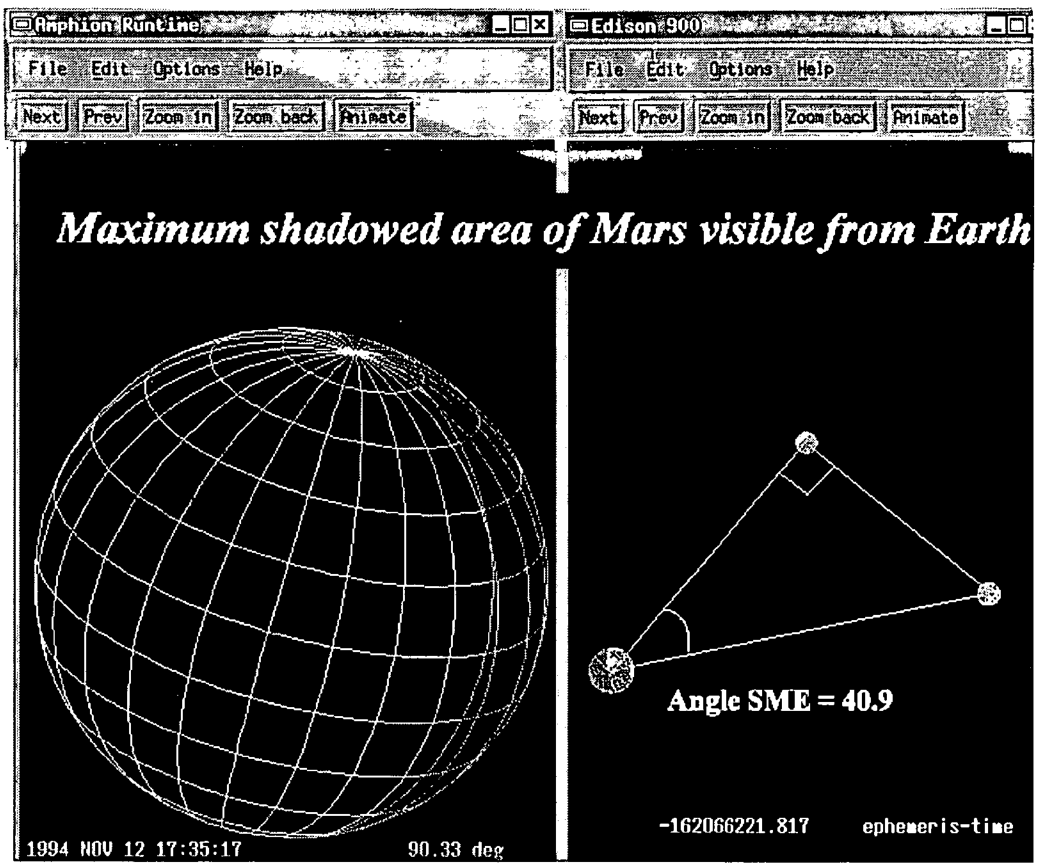

Figure 2: Still from Amphion-generated animation used to illustrate the phases of Mars as seen from Earth.

5. Lesson 2: "The Seasons"

5.1 Original Explanation

Children and adults alike have trouble understanding the causes of the seasons. Many will express the belief that the change in seasons is caused by the change in the distance between the Sun and the Earth. This

explanation would imply that winter and summer occur simultaneously in the northern and southern hemisphere, which is not true. When it is winter in the northern hemisphere it is summer in the southern hemisphere and vice versa. Winter occurs in the northern hemisphere when the Sun is closer to the Earth. The seasons are caused by the tilt of the earth on its axis, and the effect this has on the angle with which the Sun's rays strike the Earth's surface. Now in fact this angle will not be constant over the course of the day. The Sun's rays will strike the earth most directly at noon. In winter, when the days are shorter, the Sun's rays strike less directly and over less time. To actually calculate the amount of energy absorbed by the earth would again require fairly sophisticated mathematics -- college level mathematics. But the National Science standards specifically mention the causes of the seasons as important content for grades 5-8. What these students need to understand is not the precise mathematical relationship, but the general relationship between the angle of the Sun's rays and the amount of warming energy which this transfers to the earth. Traditional teaching methods with physical models and lights are helpful for some students, but many still do not understand.

5.2 Amphion's Explanation

Amphion's capabilities are excellent for providing additional teaching tools that may help some learners understand this difficult but important concept. Amphion can produce an animation that shows how the angle of incidence of the Sun's rays changes over the course of a day, or at noon over the course of a year. This can show students the correlation between this angle and the seasons.

In order to explain the concept of seasons, an animation showing the view of the Earth from the Sun for a period of time is used. Two reference points are displayed in this animation, one of them is Canberra (Australia), and the other one is its mirror image in the Northern Hemisphere. The solar incidence angle computed from the Normal to the Earth's surface is displayed at each of these points. Then each point is color coded according to the corresponding season of the year. The incidence angle is computed at around 12:00 noon local Canberra time, which is the warmest time of the day. The smaller the angle, the closer the Sun's rays are to the perpendicular to the Earth's surface at that point.

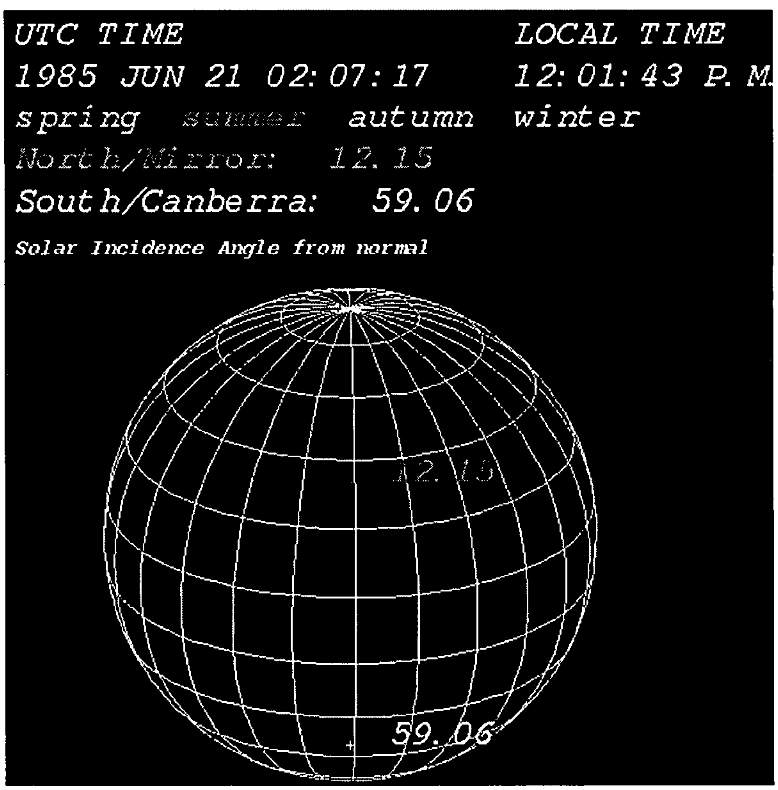

Figure 3: Still from Amphion-generated animation used to illustrate the seasons on Earth.

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(Fig. 3) shows a snapshot of the live animation where we can see that the angle is smaller in the summer (i.e. when it is red in the animation). Likewise, the angle is much larger in the winter. Also, a summer point is visible longer than a winter point, indicating that summer days are longer than winter days. Several misconceptions, such as the belief that the seasons are due to the change in the distance between the Sun and the Earth, can be eliminated by experimenting with this animation.

The URL for this lesson is http://ic-www.arc.nasa.gov/ic/projects/amphion/SEASONS/seasons.html.

6. Conclusions

This project has demonstrated that Amphion has the potential to be useful in K-12 education. Amphion was used to create animations that became the heart of two different web sites, each dedicated to a notoriously difficult space science concept. In each case, Amphion was able to do something a bit different than traditional methods, and thus was a powerful supplementary teaching tool. But in fact this is only the beginning for the development of educational uses for Amphion. In the future, students will be able to interact more directly with Amphion and through the use of simplified templates conduct their own investigations of space science phenomenon. Each of these web sites is a rough draft, they need refinement, rewriting and the inclusion of supplementary materials, such as lesson plans, correlations with standards, and follow up assignments and activities, which will make them more useful to classroom teachers. In refining these web sites we hope to get input from the educational community to make them as practical and useful as possible.

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Learning Styles, Technology Attitude and Usage: What are the Connections for Teachers and Technology in the Classroom?

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Abstract: . The question for educators is no longer how much better do students learn with technology, but instead how do we integrate technology into our classrooms in a way that benefits students. A specific part of integrating technology into the classroom examines how to encourage teachers to use technology to teach. To study this question, a survey was used to create connections between teachers' technology attitudes, technology usage, and learning style. Teachers from five elementary schools in a large southern California school district participated in the study. Results and implications are discussed.

Whether people want to embrace technology or not, it is necessary to be able to use it to learn, problem solve, and function on a daily basis with it. Our personal and professional lives are affected increasingly by a variety of technologies. Therefore the question for educators is no longer how much better do students learn with technology, but instead how do we integrate technology into our classrooms in a way that benefits students. A specific part of integrating technology into the classroom examines how to encourage teachers to use technology to teach. Luke, Moore, & Sawyer (1998) write that teachers need to use technology to teach if students are to learn with it. Additionally, Collis (1996) reflects on research conducted worldwide over the past decade and states, "...one type of result consistently occurs; a result that acknowledges the teacher as the key figure in the eventual success or lack of success on any computers-in-education initiative" (p. 21).

To begin understanding how to increase a teacher's technology usage in the classroom, we must learn why teachers choose to use technology. Does a person's technology usage in the world outside of work have any bearing on whether he or she uses technology at work? Is there a connection between someone's attitude and his or her technology usage? Does a person's thinking style matter when he or she considers whether to use technology or how to use it? Are there any relationships among technology usage, attitude toward technology, and thinking style? This paper examines a study that was conducted to address these issues.

Background

The researcher's experiences within the business and teaching worlds allowed informal observation of people who do and do not use technology. Why are some people willing to use technology within their jobs while others resisted? It seems logical that how you learn and how you feel about something affects what you choose to do or use. In the case of technology and teachers, this would imply that attitude towards technology and a person's learning style affect if one uses technological innovations inside the classroom. Also, if a person uses a variety of technological items at home, he or she is probably more likely to use technology to teach in the classroom.

To support these beliefs and perceptions, a literature and research review was conducted to locate studies dealing with technology attitude, technology usage and learning style. There is an abundance of research on computers, technology, and education. Many studies concentrate on attitude toward computers (Knezak & Christensen, 1998; McFarlane, Green, & Hoffman, 1997; Woodrow, 1991), or computer usage and attitude toward technology (Byrd & Koohang, 1989; Levin & Gordon, 1989; Marshall & Bannon, 1986). Fewer studies consider computer usage and thinking or learning style (Knupfer, 1989; Smith, Munday, & Windham, 1995). And, there are no studies that consider all three threads together; technology usage, attitude toward technology, and learning style.

Another issue found while researching these topics, is that it is difficult to find surveys and other research tools that examine the broader concept of technology rather than computers. Until recently, conversations about technology in education meant talking about how to use computers as teaching devices. As new technologies develop faster and faster, we are realizing that "technology" does not equal "computer" and it

has not for a long time in classrooms. Video recorders, televisions, and satellite dishes have been in schools for quite awhile, yet usually these other pieces of technology are ignored.

A survey was created to try to create connections between technology attitude, technology usage, and learning style. The survey included three scales: the Technology Attitude Scale (TAS) (McFarlane, Green, & Hoffman, 1997), the General Technology Usage Scale (GTUS) (Galowich, 1998) and the Learning Styles Inventory (LSI) (Kolb, 1985). The survey is an initial attempt to collect data from teachers about their respective attitudes toward technology, technology usage outside of the classroom, and learning style and explore the connections among these variables.

Description of Survey and Sample

The survey instrument was constructed to examine teachers' attitude toward technology, technology usage outside of work, and learning style. As already mentioned, there were many computer attitude scales but only a few technology attitude scales. Of these few scales, only one, the Technology Attitude Scale (TAS) was up-to-date when considering current technological advances. An additional benefit is that the scale was created to use with teachers. The TAS was used to assess attitude toward technology for this survey.

A few research studies examined technology usage in work settings but none of them examined technology usage outside of work situations, therefore a scale was created. In an effort to create a scale, the researcher began listing all types of technology that people encounter in their daily lives. To capture a range of technology usage common technological items (e.g., sewing machine, television, stereo, and microwave) were included, as well as more unusual technological items (e.g., digital video disk [DVD], scanner, and electronic datebook/organizer). The original list had approximately 40 technology items found in households or non-work environments. The list was narrowed down to 20 items to make it a more acceptable length and to avoid score inflation due to including too many common technological innovations. The final scale was measured with a six point frequency scale that was used to assess usage patterns (an example item: I use a cordless phone... 1=never, 2=rarely, 3=several times a year, 4=at least once a month, 5=at least once a week, 6=daily). Additionally, a question was included to determine if a teacher uses technology to teach in the classroom. These 20 usage questions compose the General Technology Usage Scale (GTUS).

The final scale included in the survey needed to provide a way to assess cognitive learning or thinking style. Previous research (Knupfer, 1989; Smith et al, 1995) examining thinking/learning style and technology attitude used the Myers-Briggs Type Indicator (Myers & Briggs 1976) scale but this is a personality type preference, not a learning or thinking type. David Kolb (1976, 1985) created the Learning Style Inventory (LSI) to assess learning styles based within the Jungian idea that styles represent different modes of learning and people use all modes with the predominant one being the designated "style" or "type". The four styles are Accomodator, Diverger, Converger, and Assimilator. The styles are created based on a preference for learning actively versus reflectively and in an abstract versus concrete way. The 1985 revised scale was used for this study.

A large school district in southern California agreed to have teachers from five schools participate in the study. Surveys (with an attached, stamped envelope) were given to principals to pass out to their teachers. Of the 120 surveys given to the principals, 79 were returned and 74 were used for statistical analysis. Both the TAS and GTUS included a definition of what should be considered as technology, "For this survey, technology is defined as materials such as computers, VCRs (video recorders), televisions, radio/tape cassette players, laser discs, printers, scanners, microwaves, etc.".

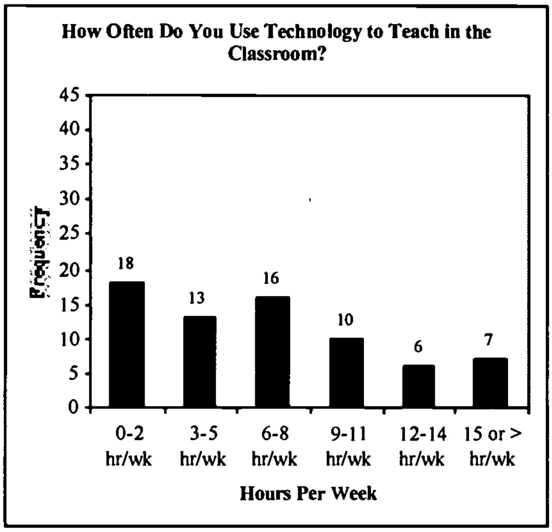
Data Analysis and Results

Description of Sample

Each teacher was asked to pick the appropriate age range for his or her age. The ranges were 20-29 years old (n=26), 30-39 years old (n=22), 40-49 years old (n=10), 50-59 years old (n=12), and 60 or over (n=1). The ethnicity/racial identity of the sample is split mainly between Hispanic American/Latino/Chicano teachers (n=29) and European American/White teachers (n=32); with 1 teacher identifying him or herself as Asian American/Asian; three teachers identifying themselves as Multiracial/Multiethnic and three teachers identifying themselves as "Other".

Using Technology to Teach

The question, "How often do you use technology to teach in the classroom?", that was used to ascertain whether teachers use technology to teach in the classroom is a categorical variable with six choices (See Fig. 1). Yet, the statistical tests are run according to whether teachers use technology to teach in the classroom or not. So, the original variable was recoded to create a dichotomous (yes/no) variable, "How often do you use technology to teach in the classroom?" as shown in Fig. 1. The decision was made to make the cut off point at 5 hours per week for the response "no". Many teachers may use an overhead, VCR, tape recorder, etc., to present lessons throughout a week, yet not really using the technology as an active part of their teaching. So, it is necessary to include a small amount of use in the "no" response category.



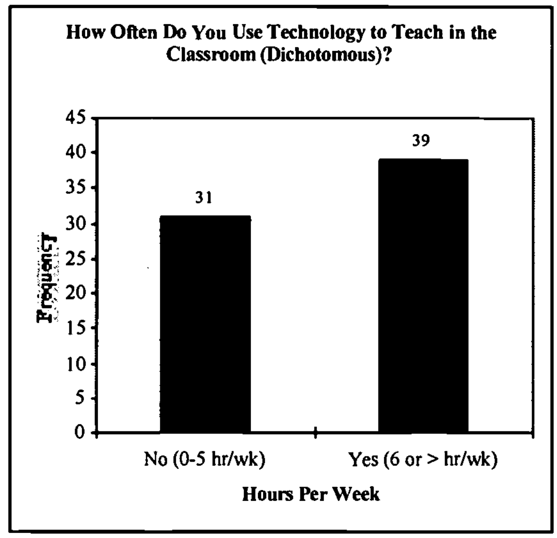


Figure 1. Teacher Use of Technology to Teach, Original Variable and Dichotomous Variable Frequencies

Crosstabs were run to allow comparisons of whether teachers of different ages and ethnicity use technology to teach. First, technology usage and age were examined. More teachers use technology to teach than do not across each age range (20-29, no=7, yes=15; 40-49, no=2, yes=5; 50-59, no=4, yes=7) except for the age range 30-39 where the opposite occurred (no=13, yes=8). The next crosstab displayed ethnicity and whether teachers use technology to teach. More Hispanic American/Latino/Chicano teachers use technology to teach (n=21) than do not (n=8), while less European American/White teachers use technology to teach (n=12) than do not (n=17). Something more interesting to consider is the crosstab that displays age, ethnicity, and teachers who use technology to teach as shown in Tab. 1. The Asian American/Asian, Multiracial/Multiethnic, and Other ethnicity categories along with the age range 40-49 category were not included in the table because each category had a sample of five or less. The trend in this sample is that more Hispanic American/Latino/Chicano teachers in each age range use technology to teach than do not while less European American/White teachers in each age range use technology to teach than do not.

Age	Ethnicity	Do You Use Technology to Teach?	
		NO	YES
20-29	Hispanic American/Latino/Chicano	2	11
	European American/White	5	4
30-39	Hispanic American/Latino/Chicano	4	6
	European American/White	7	2
50-59	Hispanic American/Latino/Chicano	1	2
	European American/White	3	5

Table 1. Crosstab for Ethnicity by Do You Use Technology to Teach Across Selected Age Ranges

Learning Style

The final score for the LSI allows one to categorize each teacher's responses to the 12 items into one "style". The learning style frequency indicated there were 20 teachers classified as Accomodators, 10 teachers as Divergers, 12 teachers as Convergers, and 12 teachers as Assimilators. It is more interesting to examine the LSI when age and ethnicity are considered. A crosstab, as shown in Tab. 2, was created to examine trends across age and ethnicity for learning style. The Hispanic American/Latino/Chicano 20-39 year old teachers tend to be Accomodators (n=9) but Assimilators (n=5) and Divergers (n=4) are represented in this sample as well. European American/White 50-59 year old teachers were all classified as Accomodators (n=5). Finally the 30-39 year old European American/White teachers were evenly split across all four styles (n=2 for each).

Age	Ethnicity	Learning Style			
		Accomodator	Diverger	Converger	Assimilator
20-29	Hispanic/American/Latino/ Chicano	5	2	1	2
	European American/White	2	0	3	1
30-39	Hispanic/American/Latino/ Chicano	4	2	1	3
	European American/White	2	2	2	2
50-59	Hispanic/American/Latino/ Chicano	0	1	1	1
	European American/White	5	0	0	0

Table 2. Crosstab for Ethnicity by Learning Style Across Selected Age Ranges

Learning Style and Using Technology to Teach

Finally as shown in Tab. 3, a crosstab was run to examine if there is a relationship between learning style and whether or not teachers use technology to teach. For all learning styles except Accomodator, there were about as many teachers who use technology to teach as those who do not except for the Accomodator style. Even with the slight difference among Accomodators, there are no significant differences (a chi-square was calculated to test significance) when examining each learning style and whether or not a teacher uses technology to teach. This trend continues when correlations and t-tests are run.

Learning Style	Do You Use Technology to Teach?	
	NO	YES
Accomodator	8	12
Diverger	5	4
Converger	6	6
Assimilator	5	6

Table 3. Learning Style by Do You Use Technology to Teach Crosstab

Correlations and T-tests

The learning style could not be used for statistical analysis because one style is not better than another one. However, the styles are determined by deriving "scores" on two continuous scales. These two scales are the Abstract Conceptualization-Concrete Experience scale and the Active Experimental-Reflective Observation scale. So, LSI1 represents the Abstract Conceptualization-Concrete Experience scale while LSI2 represents the Active Experimentation-Reflective Observation scale. Variables included in the correlation were TAS total score, GTUS total score, LSI1, LSI2, and how often technology is used to teach in the classroom (TECTEACH). Due to a low response rate on the LSI (some subjects filled out this scale incorrectly while others chose not to complete it at all), correlations with one of the two LSI variables had n=52 or 54. Other correlations had n=70, 74, or 75.

There were two significant correlations (see Tab. 4) both involving how often technology is used to teach in classroom. The relationship between technology usage outside of work and technology usage to teach in the classroom is moderate. Attitude toward technology and use of technology to teach in the classroom has a slightly stronger relationship than the GTUS/TECTEACH correlation. Interestingly, there was not a significant correlation between the TAS and GTUS total scores (r=.203, p=.084, n=74). Neither LSI variables had significant correlations with any of the other variables.

Variables in Correlation	r	p	n
GTUS/TECTEACH	.293	.014*	70
TAS/TECTEACH	.376	.001**	70

*p<.05, **p<.01

Table 4. Significant Correlations for Technology Survey

To examine if there were differences between teachers who use technology to teach and those who do not, t-tests were performed. Of the four T-tests run (TAS, GTUS, LSI1, and LSI2), TAS and GTUS had significant results as shown in Tab. 5. So, while learning style did not vary significantly between teachers who use technology and those who do not, technology attitude and usage outside of work did.

Variable	t	p	df
GTUS Total	-2.208	.031*	68
TAS Total	-2.851	.006**	68

*p<.05, **p<.01, Grouping Variable: Do you use technology to teach?

Table 5. T-test results for GTUS and TAS

Implications

From the correlation analysis, we know a teacher's use of technology to teach in the classroom is more likely to be higher when his or her attitude (separate from usage) and technology usage outside of work (separate from attitude) are higher. Yet, in this study there was no significant relationship between technology attitude and usage of technology outside of work. This relationship needs to be studied further to determine if there might be an interrelationship between attitude and outside usage when using a larger, more diverse sample.

In addition to the significant correlations found in the study, there were significant differences between teachers that use technology to teach and those who do not, in their technology attitude and technology usage. This seems to make sense since the more experience one has with something, the more comfortable one feels in using it in a variety of situations. The question becomes which variable(s) causes the other(s). More research with a larger, more diverse sample needs to be conducted to see if these relationships continue to exist and if the direction of the relationship can be determined.

With this sample, there was not a statistically significant relationship between attitude and usage outside of work. Also, there are no relationships or significant differences between groups of teachers with learning style. In both instances, low sample size, the sample itself, and/or no relevance may be why there were no significant findings. To find out if these results (both the significant and non-significant) are accurate, more research must be conducted with this survey.

Contemplating what the data analysis means to the questions posed in the beginning of the paper, it seems there is a relationship between a person's technology usage outside of work and whether or not a teacher uses technology to teach in the classroom. Likewise, there is a relationship between technology attitude and whether or not a teacher uses technology to teach in the classroom. Whether there are interrelationships between technology attitude, usage, and learning style was unable to be determined. Future research must include statistical analysis that produces a MANOVA, multiple regression, or other similar analysis techniques to determine interrelationships among the dependent variables, as well as to examine the unique contributions each variable may make to explain or predict whether teachers use technology to teach.

The results of this study suggest the possibility that relationships exist across technology attitude, usage outside of work, as well as usage to teach. Additionally, the descriptive analysis points out differences

across age ranges and ethnicity in whether teachers use technology. Further research must be done to explore how strong these relationships and trends are and whether attitude and usage can help predict a teacher's usage of technology to teach. This is important to find out because if we can figure out why teachers are inclined to use technology to teach, then we can try to create technology training programs that foster teachers' positive attitudes and usage. Additionally if there are correlations with learning styles, we can better tailor these training programs to meet the needs of different types of learners.

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Designing Curriculum-Based Telecomputing Using Activity Structures and Action Sequences

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Abstract: *Curriculum-based* educational projects that involve use of Internetworked tools are quite different from *telecomputing* projects that have some curricular connections. The former (tool application) is far more important in students' learning than the latter (tool operation). How can we design curriculum-based telecollaboration that is worth the time, effort, and expense involved? Thinking tools for teachers ("wetware") called "activity structures" and "action sequences" can help provide practical answers to this rarely-asked question. The 25 tools, along with their etiologies, example implementations, and reasons for use, are shared in this paper.

Most of our Internet-related learning to date has been about *tools;* specifically, software which can help us to locate and create information, either individually or collaboratively. When we've been teaching about the Internet, for the most part, we've been teaching students to use Internetworked *tools.*

Yet, as teacher educators, we know that tools, no matter how powerful their educational potential, don't directly help students to learn. What's important is how we *use* the tools to assist teaching and learning. In other words, there is a big and important difference between:

(using the *tools* (operation) and
(*using* the tools (application).

Operating Internetworked tools is an important, but merely prerequisite step toward creating powerful telecollaboration and teleresearch in classrooms. How to *apply* the tools in curriculum-based educational activities, although less frequently the target of careful thought and in-depth investigation, is a much richer, more complex, longer-term, and more critical area for teacher educators to explore at this point in time.

Why haven't more of our workshops, conference sessions, and Internet-related publications addressed how to apply Internet-based tools in elementary through secondary curricula? There's a common, but usually unstated, assumption held that explains the pattern. It presumes that learning to operate hardware and software is most of what is involved in successfully integrating use of computer-mediated tools into K-12 classrooms. How to create and enact successful educational applications which integrate use of software and hardware is assumed to be obvious, once the tools themselves are known. This is part of what Seymour Papert long ago dubbed "technocentric thinking" (1987 p. 22). The tool, in and of itself, no matter how powerful its features, cannot make learning happen. The tool's user/teacher, no matter how technically competent, enters a related, but distinct realm for inquiry when s/he plans for educational application of any new tool. It is into this *educentric* realm that I invite you.

Lesson Plans? Not!

How is curriculum integration of Internet tools and resources usually addressed? By examining existing projects...period. Yet when teachers are asked to wade through large collections of lesson plans, replicate projects from other classrooms, or follow overly-prescriptive directions for educational activities written by folks who can't possibly know their students as they do, they are asked to ignore much of what experience and reflection have taught us. Using Internet tools and resources in our classrooms in ways that will benefit students and teachers - in ways

that are truly worth the time, effort, energy, and expense - call upon us to function more as *instructional designers* than direction-followers. Creating and implementing learning activities as a designer is an artisan's endeavor. I suggest that we speak to each teacher as that artisan; as chef rather than cook; conductor rather than metronome; educator rather than automaton.

How can we, as teacher educators, encourage teachers to use telecomputing tools and resources in powerful, worthwhile, curriculum-based ways, functioning as instructional designers without overburdening an already-challenging workload and schedule? We can teach them to consciously utilize two complementary sets of thinking tools ("wetware"), illustrated with a wealth of corresponding real-world, classroom-tested project examples, to efficiently and effectively create curriculum-based activities for their unique classrooms. These design tools are not prescriptions, or step-by-step directions, or blackline masters. They are two special types of thinking tools that I call *activity structures* and *action sequences.*

Is it "worth it?"

What's one way to save time and energy in our classrooms? Choose educational activities that give students maximal return for the amount of time and effort that all of us must expend to ensure success. There is a point of diminishing returns, the location for which each of us estimates when we consider the implementation of a new technique. In a phrase, teachers decide whether the new application is *worth it.* In terms specific to educational telecomputing, is a particular use of an Internet-based tool or resource in a particular situation for a particular group of students and teachers worth the time, effort, expense that it will take to use the tool or resource in this particular way? Note that this is not a unilateral decision about all Internetworked information and implements for all time. Instead, the "Is it worth it?" test is applied *each time* the use of the Internet is considered in an educational situation. That implies that answers to the "Is it worth it?" question will change as people and resources change. The ease and speed of Internet access in your school and classroom will continue to change. What is possible and available on the Internet will continue to change. As teachers and students learn more about and do more with Internetworked tools and resources, they (and we!) will continue to change, too.

How can we best make this decision each of the many times that we will be called upon to do so, and to help others in doing so? I suggest that, keeping in mind a specific, feasible educational use of the Internet, and in terms of both content and processes that students need/want to learn, we consider the honest answers to two questions:

(*Will this use of the Internet enable students to do something that they couldn't do before?*
(*Will this use of the Internet enable students to do something that they could do before, but in a better way?*

If the honest answer to both of these questions is "no," there is no reason to use Internet tools or resources in the way that we are considering. Our time, effort, and resources would be better used in another way. In any particular instance, if using traditional tools and approaches can allow students to learn just as well or better than using new tools and approaches, it doesn't make sense to use new tools in traditional ways. It isn't "worth it" to do so, for students *or* for teachers.

This implies that when we do use these new tools, usually it will only be "worth it" for us to do so if they can be applied in new ways to help new and worthwhile things to happen in our classrooms. "Well, that's obvious," you might be thinking. Perhaps. Yet, whenever we are offered new tools, something interesting happens. Most of what we initially do with the new tools looks very similar to what we did with older tools that were functionally similar to the innovations. When teachers first began to use electronic mail and electronic bulletin boards in elementary, middle-level, and secondary classrooms in the early 1980's, for example, what kinds of projects were most prevalent? *Keypal* projects! This pattern makes sense if we realize that electronic mail was first seen with reference to its similar predecessor, surface mail. Penpal projects, using paper, envelopes, and stamps, were successful educational activities in classrooms long before networked computers were in the world. At first, electronic mail was seen as faster surface mail. Later, as users continued to experiment with and exploit this global communications tool, our visions of how e-mail can be used for educational purposes expanded. Now there are at least seven different ways (of which keypals is only one) that interpersonal exchanges can help students to learn.

How can we encourage teachers to use telecomputing tools and resources in powerful, curriculum-based ways that are "worth it," making sure that they function as instructional designers without overburdening an already-challenging workload and schedule? We can help them to consciously utilize a set of design tools, along with a wealth of corresponding real-world, classroom-tested project examples, to efficiently and effectively create curriculum-based activities for unique classrooms. These design tools are not prescriptions, or step-by-step directions, or blackline masters. They are a special type of thinking tool that I call an *activity structure.*

Wetware Tools: Activity Structures

What's an activity structure? Let me begin by telling you what it's *not.* It's not a model, template, plan, mold, or example. It's a flexible framework, much like the wooden frame of a house or the skeletons in our bodies. Its basic shape is clear, strong, and simple, but, as with houses and humans, the same frame can support a myriad of different architectural or bodily expressions. The structure literally holds up the house, *creating spaces* for living. In a similar way, activity structures can support the generation of powerful educational environments, or spaces for learning and teaching, which are constructed, decorated, and used in customized and ever-changing ways, according to the needs and preferences of their inhabitants.

The activity structure, then, is a teacher's instructional design tool; a piece of "wetware." It is a way for us, in our conversations with ourselves and others, to capture what is most powerful in a particular type of learning activity, and communicate that in such a way as to encourage the creation (not replication) of individualized, context-appropriate environments for learning. It's as if the activity structure is the frame of the house, resting firmly upon the conceptual foundation of this architectural approach to building potentially powerful learning spaces. The frame gives shape and strength to the actual learning activity, but it is completely flexible, so that the walls, roof, doors, windows, and decor are content-specific, student-centered, individualized according to preference and past experience, and reflective of locally available resources. The same frame can support many houses whose external appearances and intended functions are actually quite different. Which do you think would result in houses that are maximally serviceable and aesthetically appealing: limiting architects to a standard procedure for design with little room for variation, or inviting the exercise of their expertise and creativity? It is important for us to practice instructional design in the traditions of architecture and crafting, rather than replication and assembly.

There are 18 telecollaborative activity structures that I have identified to date. Due to space limitations, and since I described earlier versions of each of these structures in a previous SITE *Annual* (Harris 1994), I will merely list the structures here, adding online and off-line references through which more detailed information can be obtained. The structures group themselves into three genres of educational online activity. *Interpersonal Exchanges* include: keypals, global classrooms, electronic appearances, telementoring, question-and-answer activities, and impersonations. *Information Collection and Analysis* activity structures include: information exchanges, database creation, electronic publishing, telefieldtrips, and pooled data analysis. *Problem Solving* structures include: information searches, peer feedback activities, parallel problem solving, sequential problem solving, telepresent problem solving, simulations, and social action projects.

You may be wondering why I am emphasizing this notion of flexible frameworks for instructional design. Do you think that activity structures need not be consciously processed, because we use them quite effectively without realizing that we do so? This may be so, with one important proviso. *Specific activity structures are often limited in scope and application according to the tools and resources that are available for their implementation.* In other words, existing activity structures are often best applied using existing instructional tools. Remember the "worth it?" test? If a particular educational use of Internet tools and resources is going to be "worth it," according to the definition that I suggested above, it must enable students to do something that they need or want to do, either that they haven't been able to do before, or they haven't been able to do as well. Using *new* structures to design curriculum-based educational telecomputing activities can help us to increase the chances that these applications will be both "worth it" and custom-tailored to the unique combination of characteristics that describe a particular group of students, working with a particular teacher, in a particular classroom, school, and community context.

Want to learn more about activity structures for curriculum-based telecomputing projects? Additional information is available online at: http://cwf.cc.utexas.edu/~jbharris/Virtual-Architecture/ and in the September 1998 issue of *Learning and Leading With Technology*. In-depth information on this professional development/instructional design

approach is available in the book, *Virtual Architecture: Designing and Directing Curriculum-Based Telecomputing* (Harris 1998).

OK...*Then* What?

Designing curriculum-based learning experiences for and with students is like planning, building, finishing, and furnishing a home. When houses are built, spaces for living are created. When educational activities are designed, spaces for learning are established. Different rooms in the home serve different purposes, but rooms with similar purposes (like kitchens) in different dwellings can look and function quite differently. Similarly, the same activity structures can be used to help students at different levels and with different curricula learn in differentiated ways that are best suited to their interests and needs.

Once an educational activity is conceptualized, however, it should not, in most cases, be implemented until students' learning-related *actions* are planned. In order for teachers to know that a learning activity is ready for implementation in the classroom, the component processes in which students will engage, their approximate sequence, and the resources needed to support learning must be determined. Analogously, designing a kitchen doesn't directly imply what we need to do to fix dinner tonight.

A house's frame and finishing help to create different spaces, or rooms, with different purposes. Actions in various parts of the house differ, in part, based upon the nature of the spaces in which they occur. Yet similar actions can happen in different ways in different parts of the house. Analogously, once teachers have designed an Internet-supported educational activity (the flexible frame), how can they know how to help students to participate in and with it? To assist with this more process-focused kind of planning, I have recently identified seven *action sequences* that can be combined within and across *activity structures*, which also are combined to create viable curriculum-based learning experiences. Activity structures help form the general plan for the learning project, while action sequences help plot the steps that students will take as they use the activity's structure to engage in active learning.

Action "C-Quences"

The seven action sequences used in Internet-supported, curriculum-based activities that I have observed to date are described, with project examples, below. Additional examples are available online at: http://www.tapr.org/~jbharris/action-sequences.html

Correspond:

Prepare a communication locally then send it to others. They respond, and the process continues.

Journey North's Phenology Data Exchange project (http://www.learner.org/jnorth/pde/PhenDataExchange.html) asks students, "Using nature's clues, can you find your partner?" Locally, participating classes observe natural phenomena such as number of hours of daylight, length of a meter stick's shadow at noon, temperatures, date of last snowfall, dates tulips and tree leaves emerge and bloom, and dates when the first frog, robin, hummingbird, butterfly, or monarch egg is seen and/or heard. Students share these data, usually by e-mail, with classes in other parts of the world without knowing where the other classes are located geographically. Participants then communicate across the miles, using the data exchanged to deduce the approximate locations of partner classes, and to compare and contrast how and when seasons arrive in different places on the Earth.

Compete:

Register to participate, then do an activity locally. Submit completed work by a deadline, then receive feedback.

Teams of K-12 students and student-selected coaches (usually teachers) compete each year in Advanced Network & Services' ThinkQuest (http://www.thinkquest.org/), a contest that encourages students to create educationally sound, Web-based learning environments for other students to use. Large monetary and scholarship prizes are awarded in several categories each year to participating students, coaches, and schools. More importantly, all ThinkQuest educational site entries remain online for learners and teachers around the world to use.

Comprehend:

Locate online resources, then make primarily local use of them.

Bernie Dodge and Tom March created WebQuests (http://edweb.sdsu.edu/webquest/webquest.html) in 1995 at San Diego State University. Since then, this powerful illustration of the "comprehend" action sequence has spawned many rich learning activities for students and worthwhile professional development for teachers. What's a WebQuest?

> A WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to use learners' time well, to focus on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis and evaluation.
> (Dodge & March, http://edweb.sdsu.edu/webquest/overview.htm)

Collect, Share & Compare:

Create something locally, then add it to a group of similarly-created works, combined to form a centrally-located collection.

David Warlick's Global Grocery List Project (http://landmark-project.com/ggl.html), now in its 11th year, helps students from all over the world to collect prices for each component of a common 15-item grocery list. The list includes items such as rice, oranges, peanut butter, coffee, and premium unleaded gasoline. Participating classes use the price lists contributed by their peers and posted at the GGL Web site to discover which items are more expensive in which places. Once these patterns are identified, students can begin to research and discuss *why* these differences in cost are observed, using additional data on average housing costs, average percapita income, and specific geographic location that each participating class posts.

Chain:

Do an activity locally, create records of that activity, then send something on so that the next group can do something similar.

First grade teacher Evelyn Kelley's Backpack Buddies (http://scott.net/~ekelley/bkpkbuddies/), one of several Travel Buddies (http://rite.ed.qut.edu.au/oz-teachernet/projects/travel-buddies/travel-buddies.html) projects conceptualized and supported by Lindy McKeown in Australia, are "traveling teddy bears that visit your room for one week." They come in backpacks, along with postcards, journal entries, and other artifacts added by classes whom the teddy visited earlier. There are also suggested learning activities to be done while the bear is visiting, and pictures, stories, and reports of special activities in which the bear was engaged in each classroom are displayed on the project's Web page. Once a visit is over, the bear is packed into its backpack and shipped by first-class surface mail to the next classroom in the project's sequence.

Come Along:

Shadow others as they travel either physically or cognitively, perhaps communicating briefly in the process.

There are many rich telefieldtrip experiences available on the Web.

GlobaLearn's spring 1999 Eastern Mediterranean Expedition (http://www.globalearn.com/expeditions/eme.html), for example, allows us to shadow a team of adult and student explorers as they travel through countries that border the Mediterranean sea on its eastern shores. In the process, virtual travelers can learn much about the history, current conditions, cultures, and people - especially children - in this important area of the world. The route for this expedition is overviewed at the GlobaLearn site in this way:

> The GlobaLearn expedition team will begin in Alexandria, Egypt, and travel through many of the countries that border the eastern Mediterranean, including Israel, Lebanon, Turkey, Greece, Italy, and Tunisia. Visit the ruins of Athens and learn about the Ottoman Empire, while meeting local children living today in these historically significant countries. (GlobaLearn 1998 http://www.globalearn.com/expeditions/eme.html)

Collaborate:

Work with remotely-located others to realize a common goal.

On April 1, 1999, Canada will have a new territory called Nunavut (noo-na-voot), an Inuktitut word that means "our land." Students in Canada have been participating in teacher Bill Belsey's Countdown to Nunavut Project (http://www.arctic.ca/LUS/Nunavut.html), learning much about the new territory and collaboratively designing aspects of the new government that will serve the people of Nunavut. Student teams' suggestions have been submitted as reports to the Nunavut Implementation Commission, the group of governmental officials which has been given the task of creating the territory's infrastructure and policies.

Designs into Actions

As teachers who guide other teachers' learning, we know that true knowing comes from doing. Teaching and learning are inextricably intertwined, and since teachers are pedagogical learners, they often must take action themselves before real professional development can occur, and therefore should be willing to admit that the same is true for their students. This is why it is important to include action sequences in plans for curriculum-based learning activities. The most engagingly-structured educational project serves nobody unless it is operationalized appropriately. Such action must proceed from careful thought (hence including action sequences in project planning), because as Georges Bernanos once wrote,

> A thought which does not result in an action is nothing much, and an action which does not proceed from a thought is nothing at all. (Tripp 1970 p. 5)

Using "wetware" (thinking tools) like activity structures and action sequences can help us - and in doing so, help us to help our other educators - create effective and engaging spaces for, and feats of, Internet-supported learning.

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Adaptable Learning Environment for Supporting a Group of Unspecified Participants in Web

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Abstract: The electronic classroom in web-world is one of important and hot topics, when we consider educational system in the situation that all computers have been connected through network. Cooperative learning is a subject that arises from the topic and several researches for organizing electronic classroom aim at supporting the cooperative learning effectively. However, there are few researches that focus on promoting or supporting students smartly during the learning. Our objective is to organize electronic classroom which promotes the interactions among students successively and assists the learning process if necessary. The issue of electronic classroom, when compared with classroom in the real world, is that students cannot know others directly. Our idea for supporting the learning among such unspecified participants is to manage the progressive situation as collections of different understanding levels, but not to identify participants individually.
In this paper, we address the idea of our electronic classroom and our approach that supports cooperative learning on the basis of scenario for deriving answer. Scenario for deriving answer is a sequence of steps for an answering process attended inherently with each exercise. Additionally, three kinds of indicators are introduced to point out learning situation in accordance with actions/reactions of students.

1. Introduction

Now that many computers are connected through Internet or Intranet, the researches related closely to web-world have also been increasing in educational field. Electronic classroom is one of interesting and hot subjects among such researches. It is regarded as a learning space shared virtually by plural students to study together. Electronic classroom mainly supports students who study separately, but have the same objective. There are several researches with different purposes that focus on constructing electronic classroom. For instance, (Maeda et al. 1998) introduced virtual classroom for studying among particular members from a viewpoint of teacher. They proposed the useful lecture materials for teachers who organize the cooperative learning through web and supported real time communication between teacher and students. Also, (Hosoya et al. 1997) regarded electronic classroom as collaborate workspace among participants and addressed a virtual space in which all participants are able to change the states of shared objects freely.

Cooperative learning is a kind of group activity that all students share the same exercise at once and exchange their opinions mutually to attain to the goal. Students improve their abilities to think logically as well as get the right process of solving exercises by insisting their opinions to other students. (Liu et al. 1998) provided effective discussion environment for all participants, who are divided into five levels: teachers, operators, assistants, analysts, and students, according to the roles for each level. This research focuses on constructing interface that provides meaningful discussion means and displays the user model which represents the attitude of each student to make learning process clear. Many researches for cooperative learning aim at making up useful interfaces. However, there are few researches that focus on grasping the contents of learning and supporting participants intellectually.

In cooperative learning, sometimes interaction among students does not effect on the learning effectively: e.g. when there are no opinions from any students or when the understanding levels among participants are very different. For such cases, the promotion/assistance function that organizes an effectual learning environment and encourages the learning processes of individual students smartly takes an important role. Our objective is to construct electronic classroom in which assistant mechanism is supplied. Namely, such functional mechanism observes the learning processes among students, grasps the situation, and gives them some advices, if necessary (Kojiri et al. 1998). In this paper, we focus on representing the situation of cooperative learning, which is the foundation to achieve our final goal, and promote the learning effectively.

The classroom in the real world is physically constrained space that gives a well-defined interaction field to all participants, and makes the multi-modal specific communication among all participants possible. While, electronic classroom in web-world is a logically formed space that supports undeterministically by an ill-defined society in which all participants cannot know other participants directly, and enforces that all participants can act/react with

other participants freely. Our idea for supporting a group of unspecified participants in the logically formed web-world is to manage the progressive situation as collections of different understanding levels, but not to identify participants individually.

2. Framework

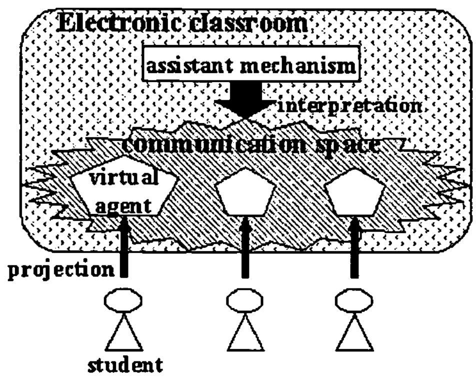

Figure 1: Conceptual illustration of electronic classroom

Figure 1 shows an imagination of cooperative learning through electronic classroom. In this classroom, students are not able to see each other directly, but they project themselves to virtual agents in electronic classroom and participate the learning by exchanging their opinions through computers. The assistant mechanism which is embedded in the electronic classroom observes the interaction among virtual agents and grasps the learning situation.

In electronic classroom, characters input by students are only means to interact with other students. In order to understand intentions of other students precisely and proceed cooperative learning effectively, it is important that students express themselves freely. Therefore, our basic idea is that minimum constraint is permitted for communication means. Also, our stance is that the system does not observe each student individually, but approximates their understanding levels to a few representative levels. In cooperative learning, students may support each other so that it is enough for the system to grasp only an approximate situation of learning.

Here are conditions of our system that we are going to investigate.

1. All students have fundamental knowledge for exercises.
2. Each exercise has only one answer and one answering process.

The process of deriving answer may be constructed differently in accordance with the levels of participants. When the learning group consists of students who have enough knowledge for exercises, they are able to solve the exercises by themselves. On the other hand, when few students have fundamental knowledge, they may need explanation in most of answering process so that the learning would be organized as a private lesson rather than cooperative learning. Since under the condition 1, there are few students who do not understand answering process at all, the interaction among students should be cooperative and progressive in many cases. Under the condition 2, the exercise which students are going to solve has always a right answer and one ideal answering process and the system enables to grasp the stage of deriving answer easily. Currently, we focus on the solution problem of mathematical expressions as exercises: especially, roots computation of equations.

2.2 Approach

In physically constrained space, we exchange our opinions and proceed cooperative learning mainly by talking each other. Also, writing sometimes takes an important role to arrange the derived answering process. Therefore, our electronic classroom provides two communication means to make logically constrained space closer to physically constrained space; one is interaction space and another is answer-board screen. Interaction space supports our ordinary conversation and it would be a main media to proceed learning. In addition to the conversation, answer-board screen is to make the learning contents that have already been derived clear. It plays a role of blackboard in physically constrained space.

For our assistant mechanism, it is necessary to grasp the path to answer in order to detect whether students are in right process for the goal. Our approach is to embed stepwise answering scenes into electronic classroom, which we define as scenario for deriving answer. Each scene in the scenario corresponds to the eventual answering scene along

time sequence: namely, scenario starts with the scene of opening question and ends with the scene of final goal. In order for the system to understand the situation of learning, we set three kinds of pointers called indicators on the scenario. One is called *current* which points out current answering scene, and the others are *upper* and *lower* which express the extents of understanding levels for learning groups. Our idea is to represent learning situation under relationships among these indicators.

3. Collaboration Support Media

3.1 Interaction Space

Interaction space is a communication media which enables to support free conversation among students. However, in order to grasp learning situation, the system must provide some commands to distinguish particular words, which are to specify answering scene on the scenario, from other parts of utterances. Now we prepare the commands shown in Table 1.

Table 1: Commands for interaction space

Command	Meaning
APPRECIATE (equation, utterance)	Proposal of new solving means
INQUIRE (target, utterance)	Question about opinion
CONFIRM (target)	Confirmation of student's understanding
ASSERT(utterance)	Other opinion

APPRECIATE is to suggest new answering method or new stage of deriving answer; INQUIRE is to question about already derived process; CONFIRM is to make sure for all other students whether they do not have any problems toward an asked stage in deriving process; and ASSERT is used for all other utterances. In spite of these commands, students are able to interact freely by filling what they want to say on *utterance*.

3.2 Answer-board Screen

Answer-board screen is a bulletin media to show derived answering process in order to arrange the learning process. We set writing right on answer-screen, since if plural students can input on this screen at one time, this screen would be a disordered memo and hardly plays a part of its original role.

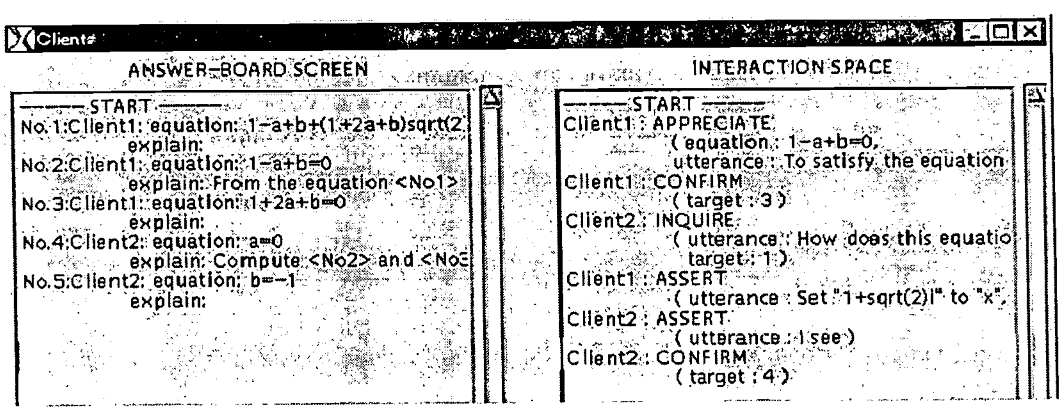

Figure 2: Interaction screens among students

Learning process in our electronic classroom is proceeded with these means. Figure 2 shows the progress of learning. These commands are prepared by the system as an interface. Students are able to express their opinions freely at *utterance* on interaction space. *Target* on the commands indicates the number labeled on answer-board screen, which is used to indicate the relationship between input on the interaction space and that on the answer-board screen. Since we focus on mathematical exercises, we set equations as particular words to specify answering scene so that equations must be written separately in some commands.

4. Collaboration Support Mechanism

4.1 Scenario for Deriving Answer

The scenario for deriving answer is a collection of ordered answering scenes prepared for each exercise. The scenario is a foundation of assistant mechanism which is embedded into the electronic classroom.
For mathematical exercise, the answering process is often divided into several stages according to the content. Figure 3 is an example of mathematical exercise and answer that were divided into several answering stages.

(a) EXERCISE
When the equation "$x^3+ax^2+bx+6=0$" has an imaginary root "1+□2I",
Compute the values of "a" and "b".

(b) ANSWER
Stage1: For $x^3+ax^2+bx+6=0$, set "(1+□2i)" to "x"
$\underline{(1+□2i)^3+a(1+□2I)^2+b(1+□2i)+6=0}$ … (1)
Stage2: Arrange the real part and imaginary part for (1)
$\underline{(1-a+b)+(1+2a+b)□2I=0}$ … (2)
Stage3: To satisfy (2), the following equations are necessarily required.
$\underline{1-a+b=0}$, $\underline{1+2a+b=0}$ … (3)
Stage4: Compute (3) for "a" and "b", which satisfies (3) at once.
Thus $\underline{a=0}$, $\underline{b=-1}$ … (4)

Figure 3: Example of exercise and answer

It is assumed that answering scene also changes among divided stages. Our idea is to define each stage as a state in the scenario, so that scenario is composed of ordered states. Individual states have particular words to distinguish from other states, which we call state-words. For mathematical exercises, each stage contains one or more important equations, like equations underlined in Figure 3. Thus, we set state-words to each state for equations in the stages. From these definitions, Figure 4 represents the scenario for exercise in Figure 3.

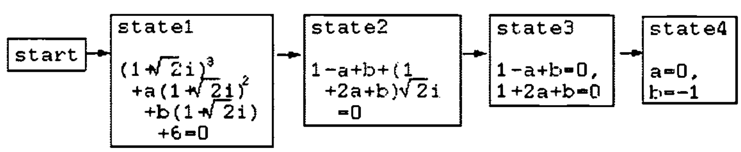

Figure 4: Scenario for exercise in Figure 4

4.2 Indicators

As we mentioned in Section 2.3, we prepare three indicators on the scenario, *current*, *upper* and *lower*, to express learning situation of the group. *Current* points out current discussing state; *upper* indicates the state that best understandable student reached until now; and *lower* indicates the state that worst understandable student does until now. The system grasps the learning situation from the relationships among these indicators. For instance, the system detects that the whole learning has completely finished when *lower* points to the last state, or that some students may not join on learning effectively if the distance between *upper* and *lower* is too long.
Indicators move according to the inputs from students. Namely, indicators change the pointing state when there are state-words in the corresponding inputs. *Current* reacts from the inputs that may change discussing states forward or backward, which are equations on answer-board screen or command APPRECIATE or INQUIRE on interaction space. *Upper* moves according to inputs on answer-board screen or command APPRECIATE on interaction space, and *lower* changes state from command CONFIRM on interaction space, because asking is only way to grasp other students' understanding levels.
Figure 5 is an example of situations changed according to the inputs by students. In this example, it is clear that indicators express approximate learning situation according to students' input, if they write state-word correctly. While the indicators do not move so often, this approach is enough for representing and grasping learning situation and supporting the learning effectively.

5. Conclusion

In this paper, we mentioned our idea of constructing the electronic classroom which contains assistant mechanism. We also introduced our approach to realize assistant mechanism (especially, representing the learning situation) by introducing the scenario for deriving answer and three indicators on the scenario. Currently, we imposed on a lot of constraints for developing our framework, but the approach may be available for more flexible situation. It is because our system does not support students individually, but grasps only the situation approximately.

Our next step is to consider the following problems;

- constructing more flexible interface which makes interactions among students more natural,
- updating scenario structure, and
- grasping more complicate learning situation.

Our electronic classroom through web certainly provides learning space for plural students, but is far from physically constrained space in our real world. It is important to construct more flexible interface to be aware of other students easily and to communicate each other more naturally. Currently our scenario can represent only one process of deriving answer, but most exercises have more than one. So it is necessary to update scenario structure in order to adapt more complicate answering process, and then grasp the learning situation from relationships among

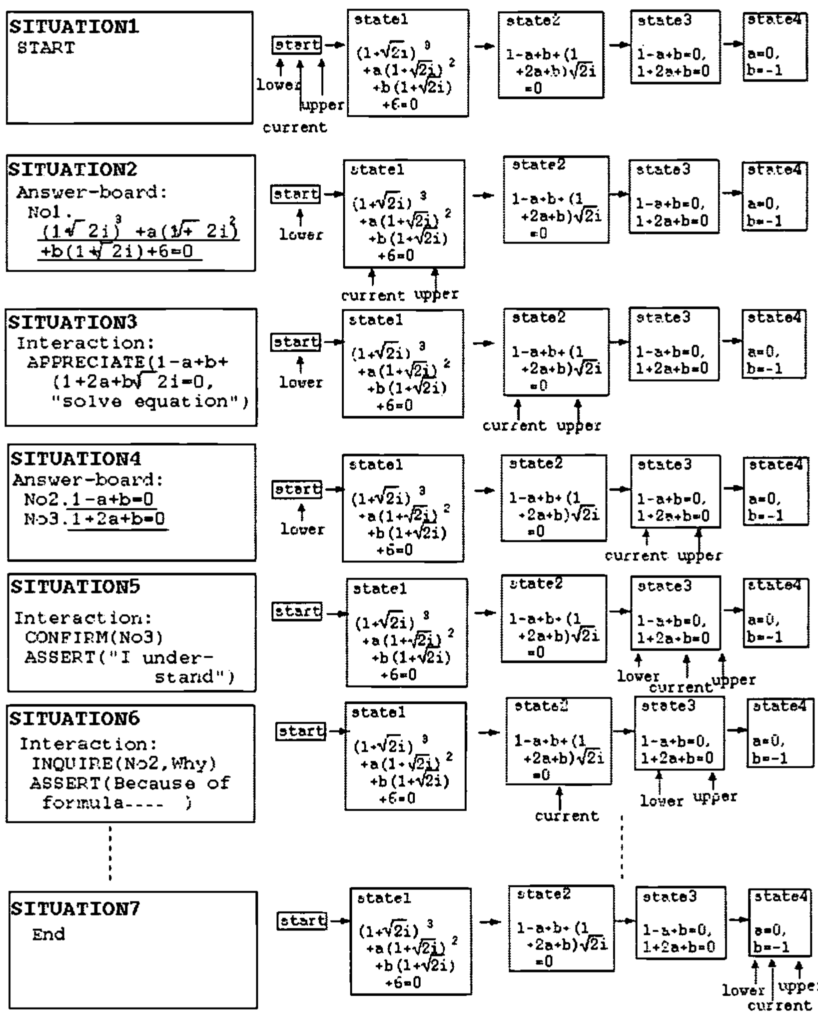

Figure 5: Snapshots of learning situation

indicators. In addition, the situation that students do not have fundamental knowledge is one of important issues. In such situation, *current* moves much frequently so that it is hard to express learning situation by only these three indicators. We should have more complex mechanism to be able to cope with such cases.

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Web Teachers Talking

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Abstract: As student teachers proceed to become teachers in classrooms, they are faced with real-world challenges that involve infusing theories acquired from their teacher education programs into existing school curricula. These new teachers are finding it increasingly difficult to attain a balance between conventional pedagogical objectives for students and market-driven needs to produce knowledge workers in their teaching practices. This is especially prevalent in a teaching-learning domain that uses web-based instruction, where teachers are compelled to deal with issues that arise from integrating the culture of Internet use with the learning culture of the more conventional classroom. In this paper, we will examine issues that emerged from an analysis of qualitative data from new teachers' reflections and videotaped interviews. The thrust of our discussion is on these teachers' practices and decisions regarding adapting web-based instruction to suit or adapt to the conventional classroom learning culture.

Introduction

Entering the teaching profession is most challenging when one is unacquainted with what lies ahead. This is especially true of a teaching-learning domain that uses web-based instruction, where teachers have to learn to resolve issues that arise from integrating the culture of Internet use with the learning culture of the more conventional classroom. Much has been said about the power of the Internet for classroom use today. We have witnessed its significant impact on information technology, as Internet tools and applications are enhanced and improved to cater to the aggressive and creative thirst of the public who uses them. For example, communication has improved substantially with the advent of the Internet technologies. As we progress into the new millennium, academia has also taken serious considerations on the impact of the World Wide Web onto its teaching-learning and research activities.

This paper attempts to address these key issues:

- Factors that facilitate or impede the use of the World Wide Web (WWW) in classroom instruction
- Considerations that new teachers have to take into consideration in making curricular decisions that involve the use of the Internet in their classrooms

Preliminary results from a larger research study have been tabulated to arrive at insights into the current perceptions of teachers on computer technology and the use of the Internet in the classroom.

Theoretical Framework

Web-learning paradigms

Learning on a novel channel, such as the Internet, redefines the way knowledge is presented and acquired. Learners will no longer be dependent on oral instructions from the instructor in front of the classroom. Polyson et al. (1998) identified some of the apparent strengths of web-based instruction:

- Personalized learning environment

- Collaborative learning
- Multimedia presentation of content
- Reinforcing content
- Up-to-date information
- Global resources
- Experiential learning
- New assessment models

Restructuring web-based curricular

As web-based resources become the basis of the curriculum, the curricular issues in education increasingly become those of ensuring that WWW tools are available and optimally utilized by teachers and their students to enable the latter to enhance participation in learning activities. Some of these issues involve making policies and decisions that will need to:

- encourage schools to shape their curricula, teachers to redesign their courses, and teachers as well as students to restructure the management of time.
- situate the locus of learning in small groups interacting with learners from all over the world to work on genuinely difficult and real-world problems.
- shift issues of curriculum design away from questions of scope and sequence towards those of problem solving and project initiation.
- redirect assessment away from measuring how well students know the mandated knowledge core to disclosing their ability to manage inquiry and solve problems.

Thus we can see how the roles of teachers in these essential schools are reconfigured just as much as the curricular structures are. Furthermore, as the contents of the curriculum increasingly become electronic ones accessed via digital networks, the range of skills required of teachers is broadening rapidly. All these changes point to a need to rethink the processes of professional development for student teachers and their trainers.

Methodology

Instrument

A set of questionnaires was distributed among 63 pre-service and in-service teachers in an undergraduate program at Universiti Malaysia Sarawak. The questionnaire consists of items on student demography, and beliefs and perceptions about language teaching and learning with the infusion of technology in the lessons. In addition, to find out these student teachers' perceptions on web-based instruction, several interviews were conducted to elicit their response to relevant issues. Due to spatial limitations, the outcome of the interviews will only be presented during the conference presentation.

Participant profile

The sample group for this study is student teachers (teacher trainees) who were enrolled in the TESL degree program at Universiti Malaysia Sarawak. They ranged from inexperienced teachers to teachers who have been teaching for ten years. The group represented six ethnic groups in Malaysia, and their native languages varied from Bahasa Melayu to Iban. English is spoken mainly as a second language, and is used in formal contexts on and off campus. English is also taught formally in school as a subject, and most of them had ten to twelve hours per week for English language learning.

The participants of the interview sessions were graduating students who had completed 95% of their undergraduate coursework, and had taken the Educational Technology module in the TESL program. They had also done projects on creating web-based learning environments for English Language learning in Malaysian English as a Second Language (ESL) classrooms.

Findings

The response rate for the questionnaire survey is 82.54% (N=63, n=52). Part A of the survey elicits general perceptions about the functions of computers in their lives. Part B narrows the scope to their perceptions about efforts to integrate computers into the language classrooms in Malaysia. Part C, focuses on their views on the use of computer-assisted instructional materials in their teaching environment (including materials available on the web). All three parts have fifteen items in each of them.

Descriptive Statistics

The data analysis, on the whole, showed a positively inclined attitude and perception toward the existence of the computer and its applications among these student teachers. The sample group was represented by a group of young teachers (indicated by the number of years they had taught, and the majority fell between 0 to 10 years' of teaching experience). They also range between 18-35 years of age.

	N	**Minimum**	**Maximum**	**Mean**	**Std Dev.**
Years Teaching	49	1	4	1.6531	0.8552
Age	52	1	4	1.7692	0.6452
Gender	51	1	2	1.7255	0.4507
Part A	49	31	71	56.2041	7.2485
Part B	51	25	69	56.3529	8.3614
Part C	48	43	72	58.1042	5.7805

Table 1: Mean and Standard Deviation Ratings for all Variables

Using the Pearson Correlation formula, it is indicated that there exists a *very strong correlation* between the student perceptions on computers (in general) and efforts of integrating computers into the language classroom (0.790). This corroborates that the sample group found computers favorable for use in language lessons and in their daily activities. This group also showed an understanding of the need to infuse technology (especially computer-based applications) into their language classrooms in Malaysia. The data indicate a strong correlation between responses for Parts B and C (0.659). It is slightly weaker than that of the first comparison, but this result shows that the sample group is optimistic and receptive about the use of technology-enhanced materials and tools in their language classrooms. Although weakest, the correlation between the first and final parts of the questionnaire indicated a moderately strong correlation between them (0.495). This data further enhance the assertion that these Malaysian undergraduate teacher trainees are generally sanguine about the opportunities to infuse technology effectively into the teaching of English language within the Malaysian educational context.

	Part A	Part B	Part C
Part A	1.00	.790**	.495**
Part B	.790**	1.00	.659**
Part C	.495**	.659**	1.00

**Correlation is significant at the 0.01 level (2-tailed)

Table 2: Analysis of Correlation between three sections in survey

To find out the strength of relationships between the sample groups' convictions on specific issues, an analysis was conducted on several questionnaire items, namely:

- Item A15: I believe that computers will be an important asset for everyone in the world in the 21st century.
- Item B14: I am trained to use computers and technology creatively and effectively in an English language learning environment.
- Item B15: I am ready to use computers in teaching English to my students.
- Item C13: I believe that Information technology offers a new skill to be acquired by language teachers to excel in teaching English today.
- Item C15: I am open to opportunities and innovations in multimedia technology in education.

All of these items generally investigated the degree of student-teachers' self-enthusiasm and confidence to deal with computers and technology for their language classrooms.

From the data analysis, as tabled below, the strongest correlation (0.561) was recorded between the items that dealt with training preparation and confidence level to use computers in classroom activities. There is also a strong correlation between items that evaluated their perceptions on technology applications for these student teachers and their optimism to the developments of multimedia technology in education. It is also vital to note that the number of years that they have been teaching *do not affect* their perceptions and optimism about the infusion of technology into their language teaching environments.

	Years of Teaching	Item A15	Item B14	Item B15	Item C13	Item C15
Years of Teaching	1.00	.066	.207	.184	-.020	-.108
Item A15	.066	1.00	.177	.229	**.497****	.218
Item B14	.207	.177	1.00	**.561****	**.402****	**.326***
Item B15	.184	.229	**.561****	1.00	**.351***	**.331***
Item C13	-.020	**.497****	**.402****	**.351***	1.00	**.549****
Item C15	-.108	.218	**.326***	**.331***	**.541****	1.00

**Correlation is significant at the 0.01 level (2-tailed) * Correlation is significant at the 0.05 level (2-tailed)

Table 3: Analysis of Correlation between specific items from survey

Discussion

Student teachers indicated that they need to cope with two challenges in their teaching environment: they have to acquire the target language in a non-native environment, and simultaneously adapt to the medium to present and educate their non-native speaking learners using the Internet. There are infinite ways in which web-based instruction can be used to empower and build strategic learner techniques directed toward good language learning behaviors. The following techniques are drawn from Brown's (1994) teaching tips for language learning and teaching , and have been infused with some apparent strengths in web-based instruction (as advocated by Polyson et al., 1998):

Lowering inhibitions: Lowering the affective filter by incorporating a variety of hypertext and graphics to create a wealth of entertaining and communicational games, and social interaction activities like chatting, discussion forums, role-plays and simulations as learning activities.

Encouraging risk-taking: Using fluency exercises, and giving outside-of-class assignments to practice speaking or writing skills; providing opportunities for communicating with other global learners using WWW resources (this accounts for the popularity of some language learning web sites, like Dave Sperling's ESL Café)

Helping them to develop intrinsic motivation: Reminding students explicitly about the rewards for learning English, for example, encouraging learners to look-up jobs on the WWW that require a good command of English.

Promoting cooperative learning: Directing students on how they can share their knowledge gained from the Internet through paired and group work.

Encouraging them to use right-brain processing: Using movies and audio files, texts for rapid reading and skimming, writing and oral fluency exercises, and other multimedia WWW resources to cater to different learning styles.

Promoting ambiguity tolerance: Encouraging students to ask the instructor and other students questions when they do not understand something they have encountered on the WWW; keeping theoretical explanations very simple and brief; dealing with just a few rules at a time; and occasionally resorting to translation into a native language to clarify a word or meaning.

Helping students to use and rely on their own intuition: Praising students for good guesses and choices they make while "surfing" the WWW; not always giving explanations of errors (letting correction suffice and correcting only selected errors, preferably just those that interfere with learning).

Encouraging students to reflect on correcting their own mistakes: Recording students' oral production using the sound recording facilities available on the computer and getting them to play back the recording and identify their own errors; letting students catch and correct each other's errors; not always giving them the correct form; encouraging students to make lists of their common errors from the recordings and to work on them on their own.

Getting students to set their own goals: Explicitly encouraging or directing students to go beyond classroom goals; having them make lists of what they will accomplish on their own in a particular week; getting students to make specific time commitments at home to study the language; giving "extra credit" work that is achievable by utilizing resources on the WWW.

The previous techniques are clearly manifestations of the strengths that web-based instruction brings with it. By lowering inhibitions, encouraging risk-taking, intuitive abilities and setting of goals by learners, the Web lends itself to student-centeredness, self-directed or personalized learning, collaborative learning, multimedia presentation of content, experiential learning, utilization of up-to-date information as well as global resources, learning in real-world contexts, and new assessment models

Paired or group work, desktop forums and web-based conferencing all encourage cooperative or collaborative learning. Duffy and Cunningham (1996) are among educators who encourage using group learning not just as a classroom management strategy but more so to promote dialogical interchange and reflexivity among learners. This involves having learners use the Internet to share alternative viewpoints, support each other's inquiry processes, and develop critical thinking skills that include the ability to reflect and improve on their own learning.

Taking into account Polyson's *New Assessment Models* paradigm, a curriculum centered upon web-based instruction will need to consider appropriate assessment models in order to evaluate and monitor the progress of the learners "we can't see, hear and interact with in person". One way to attempt to solve this ambiguity is a model proposed by Duschastel (in Gan, 1998) that provides necessary navigation for the tertiary institutions to capitalize on web-based instruction:

1. Specify goals for students to pursue rather than content to teach/learn
2. Accept diversity of learning outcomes rather than demand common learning results
3. Request production of knowledge from students rather than communication of knowledge
4. Evaluate students' learning at the task level rather than knowledge level
5. Build learning teams rather than focus on individual work, and
6. Encourage learning in global communities rather than only local communities

To optimize these learning opportunities, we first need to find out to what extent teachers and their learners are adaptive to the web-based instructional environments. How would such invaluable interactions like collaborative web-based learning be organized and used optimally in Malaysian classrooms? Also, how far are current Malaysian learners able to fit comfortably into this individualized learning environment given that they have so far been predisposed to a classroom-based rather than an individualized or self-directed approach to learning in the Malaysian classroom? Or is this more a dilemma for teachers who have been so used to taking center stage in the classroom that implementing a more learner-centered approach would pose uncertainties?

It is crucial to embed into the teacher-training curriculum the imperative need to embark on action research efforts when these new teachers begin to teach. The above questions will be answered if teachers are prepared to inquire into and seek answers to problems that arise within their own teaching environments.

Conclusion

Much has yet to be dispelled about web-based technology and its implications on teacher training curricula. The World Wide Web may perhaps have the best offer for multimedia production of lessons and self-access materials. However, effective web-based instruction and learning require a significant quantity of maturity and patience. This paper and the study findings discussed offer a perspective of the many systemic reforms in teacher thinking needed in making curricular decisions aimed at meeting learners' needs in web-based instruction.

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Some Concerns About the Concerns-Based Adoption Model (CBAM) and Technology

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Abstract The Concerns-Based Adoption Model (CBAM) originally proposed by Hall & Hord (1987) and modified by Bailey and Palsha (1992) provided a conceptual framework for the study discussed (Slough, 1998). According to the model, as innovations—in this case telecommunications technology—are implemented, individuals progress through a typical set of concerns that are progressive and to some extent sequential; and progress in one innovation does not always transfer to the newest innovation (Hall & Hord, 1987). In general, the basic assumptions of CBAM were supported by this study. Teachers at different stages of the implementation of telecommunications did have different concerns; and further, teachers at similar stages of implementations did have similar concerns. Two noted short-comings of CBAM discussed in this paper are that CBAM assumes a static innovation and that all individuals progress to adoption of the innovation.

Scientists, science educators, business leaders, and the government have all called for increased integration of technology in the science classroom, including telecommunications. The federal government, state governments, business, industry, and varied private foundations cooperated—to a degree—to develop the backbone of the Internet that will provide access to the schools. School districts are spending local money and competing for outside money via grants to access the Internet and all of its proported promise. Yet, little is known about how to implement this technology, especially in the high school science classroom.

The purpose of this study was to examine and describe the high school science environment within an emerging telecommunications-rich setting in an effort to provide a better framework for implementation of telecommunications technology in science classrooms. Research questions focused on teacher and students' use of telecommunications, barriers and supporting conditions to telecommunications implementation, and the effect of telecommunications on the teaching and learning of science. Data was collected through open-ended ethnographic interviews with 24 high school science teachers who had been in an emerging telecommunications-rich environment for at least two and one-half years as of the Fall Semester, 1997. The teachers were from a single, large, suburban school district with five high schools. The district was chosen because it provided an emerging telecommunications-rich environment and because it provided a fairly large stable population of high school science teachers who had been in that emerging telecommunications-rich environment for at least two and one-half years. In this case, the emerging telecommunications-rich environment included a district-wide infrastructure that had been in place for two and one-half years that included 24 network connections in each classroom, full Internet access from the network, four computers per classroom (teachers were required to attend training before receiving), and a variety of mandated and optional professional development opportunities within and outside the district. Teachers in the study were well distributed across each of the five high schools, across typical high school science courses, across all levels of educational attainment, and included fairly new to veteran teachers. In short, they represent a cross-section of the high school science teachers within the school district.

Five-Stage Model of Concerns

The Concerns-Based Adoption Model (CBAM) originally proposed by Hall and Hord (1987) and modified by others (Bailey & Palsha, 1992) has been employed to explain the adoption of innovations. Specifically, a five-stage CBAM model (Bailey & Palsha, 1992) provided a conceptual framework for the study discussed (Slough, 1998). The resulting five-stage model (see Table 1) includes descriptors for each of the stages awareness, personal, management, impact, and collaboration concerns. The awareness stage is characterized by

the teachers having little knowledge about the innovation but interested in learning more about it. The personal stage is characterized by the teachers who are primarily concerned with how the innovation will affect them, with a specific focus on required changes in roles and tasks. The management stage is characterized by the teacher who is primarily concerned with time management, organization, and prioritizing responsibilities. The impact stage is characterized by the teachers who focus on the effects of the innovation on learners and how this innovation can be used to change or improve learning. The collaboration stage is characterized by the teachers who focus on working with others to implement the innovation as well as sharing information about the innovation with other teachers. According to the model, as innovations—in this case telecommunications technologies—are implemented, individuals progress through a typical set of concerns that are progressive and to some extent sequential; and progress in one innovation does not always transfer to the newest innovation (Hall & Hord, 1987).

Stage	Descriptor
Awareness (n=4)	Little knowledge of telecommunications beyond its existence Unaware of how to use telecommunications Unaware of barriers and supporting conditions for implementation Unaware of the potential for telecommunications to change science teaching and learning
Personal (n=6)	Some knowledge of telecommunications, mostly of others' use Some knowledge of the mechanics of telecommunications use Primary concerns dealt with how telecommunications would affect them—their time, their energy, their curriculum Vaguely aware that telecommunications could change science teaching and learning, just not sure of the mechanism
Management (n=6)	Some, if not frequent, personal use of telecommunications Little student use, often restricted Used designated local resources to learn telecommunications Concerns dealt with how telecommunications would affect their system of management over time, students, and curriculum Primary concerns dealt with students' access to inappropriate material and support from administration Unaware of the potential of telecommunications to change science teaching and learning, sometimes in open opposition to it
Impact (n=4)	Frequent personal/professional use of telecommunications Required/allowed some student use in and out of class Primary telecommunications learning resource was local teachers and occasionally students Primary concerns involved how telecommunications would impact student learning Aware of potential for telecommunications to change science teaching and leaning and had openly embraced it
Collaboration (n=4)	True inventors with telecommunications Group use of telecommunications Required and independent student use of telecommunications Used students, local resources, and "off-site" professionals as resources Served as resource for local and "off-site" teachers Primary concerns were not with mechanics of telecommunications, but with how to sustain the momentum Aware of the potential of telecommunications to change science teaching and learning and spreading the message to all who will listen Enjoyed the challenge that change brings

Table 1
Five-Stages of Concerns Descriptors

In general, the basic assumptions of CBAM were supported by this study. Teachers at different stages of the implementation of telecommunications did have different concerns; and further, teachers at similar stages of implementations did have similar concerns. Two noted short-comings of CBAM as a theoretical framework for this study were that CBAM assumes a static innovation and that all individuals progress to adoption of the innovation. Telecommunications and the associated technologies are not a static innovation. Teachers at all levels reported that one of the difficulties with implementing telecommunications and the associated information technologies was that it was always changing, in effect constantly creating a new innovation. Also, teachers in this study—especially at the management, or third stage—seemed to have made a specific decision NOT to adopt the innovation due to their experiences, mostly negative, with telecommunications.

Technology as a Non-static Innovation

CBAM assumes a static innovation. In general, technology—specifically telecommunications in this study—does not represent a static innovation. Teachers at the lower stages, in particular, seem to be intimidated by the changing knowledge base for telecommunications. Additionally, teachers who were most comfortable with implementing telecommunications were most comfortable with the changes associated with telecommunications. In fact, they considered the challenges created by the changes to be a driving force for their involvement with telecommunications.

Telecommunications and the associated technologies clearly were an innovation. Prior to district-wide training with telecommunications, the majority of the teachers (16 of 24) did not consider themselves to even be competent computer users. To varying degrees, each teacher at the lower three stages mentioned the variability and changing nature of the technology to be a barrier to their learning and ultimately implementing telecommunications. Even with mandated district-wide training, all of the teachers at the lowest stage of adoption, awareness, had significant misconceptions about telecommunications network and technology in general. Simple changes in the log-in protocol were noted as significant reasons that teachers at the awareness level did not pursue additional training. This was also noted by teachers at the next stage, personal, as well. All six teachers had expressed dissatisfaction with having to have *both* a username and a password to use the system. Specifically, four of the six mentioned having using a computer for "surfing the Web" when another teacher had already logged on because that way they did not have to remember their own passwords (the district automatically changed passwords on a periodic basis for network security reasons).

Teachers at the management stage were less concerned with network changes and more concerned with the validity of information and that was available on the Web and its occasional lack of permanence. Instead of envisioning the value in using the Web as a tool to check the validity of data—and subsequent conclusions, or to publish original work, or to supplement traditional knowledge sources, teachers at the management stage focused on their bookmarks working one day and not working another day. One teacher remarked, "How can I send students to a Web site if I do not know that it will be up, or if the site will ever be available again?" Teachers at the highest two stages, impact and collaboration, generally considered the changing nature of telecommunications to be positive because it kept them and their students motivated to learn as the technology changed. Finally, the changing nature of the innovation—telecommunications—definitely had an effect on the implementation. Teachers that had not already adopted telecommunications considered the changing nature of telecommunications to be a barrier and those who had adopted considered the changing nature to be a supporting condition for implementation.

Non-progression to Adoption

CBAM also assumes that individuals progress along the stages of concern in a fairly linear fashion, going through successive stages to ultimately reach the highest stage (Hall & Hord, 1987). In general, this study did support a progression of concerns consistent with the five-stage model proposed by Bailey and Palsha (1992). The clear exception to this general trend was the third stage, management. Teachers at this level appeared to be resistant to significant district-wide and individual attempts to introduce telecommunications in their classroom. Teachers at the management stage clearly restricted student use of telecommunications, listed significantly more barriers and less supporting conditions for implementing telecommunications, and rejected the notion that telecommunications could, or even should, change the teaching and learning of science. These

teachers have chosen *not* to implement telecommunications and subsequently do not appear to be candidates for progression to the subsequent stages of adoption.

The restriction of student use was one of the major delineating factors in identifying teachers at the management stage. The teachers reported two primary reasons for restricting student access. The first was a fear of students gaining access to inappropriate material—including adult material, and the second was students using the Internet to cheat. All six of the teachers at this stage were concerned with student access to inappropriate material and eventually being held responsible for "student mistakes." The most vocal of the group described a rumor of "a teacher at another district who had lost their job because students were downloading pornographic images." Another quoted a recent headline about a rape/murder where the suspect had met the victim through a chat room. The fact that this had not occurred at school was apparently not as important as the fact that it might happen. The teachers were also concerned about the validity of scientific information found on the Web.

Five of the six teachers were concerned with students cheating by using the Internet. Again, rumor and speculation drove the teachers' concerns. None had actually caught a student cheating using the telecommunications; and other than copying something from the World Wide Web, they were not terribly familiar with how the student would actually cheat. One teacher said, "I know that they are doing it [cheating]; I just don't know how. And if I don't know how they are doing it, I can't stop them." He continued by saying that he had completely dropped any "library assignments because they could just download reports from those places that sold term papers when we were in college."

Teachers at the management stage had not made any instructional changes as a result of telecommunications. In fact, telecommunications had to some extent caused them to become more entrenched as "traditional" teachers. One teacher said, "I am not sure what you mean. Are you asking if I have changed how I teach because of telecommunications?" When this was indeed confirmed as the question, he said, "I certainly hope not! That seems to be the wrong way to do it. If telecommunications can't fit into how I teach, it shouldn't be in my class." Another teacher echoed a similar statement, "I would never change instructional strategies to accommodate a machine; it needs to fit into what I do." A third described another similar scenario,

> Change it? No, I don't think so. I have worked very hard to get my curriculum just the way that I want it, and I don't have any fluff in there. I don't have time to waste on this feel good stuff that some of the teachers are doing on the Internet.

All six teachers at the management stage were in various ways adamant that telecommunications would not change their teaching.

Perhaps most significant was that teachers at the management stage had considered the question of whether or how telecommunications were affecting student learning and the answer was—*it was no*; or at least, they had not seen it. Most of the teachers at the management stage were openly skeptical of telecommunications' future in the classroom. Each expressed it a slightly different manner but one teacher did summarize many others words when he said, "The proof is in the pudding, and I don't see any pudding." Others focused on the hype of telecommunications verses what it had actually produced. One teacher described the situation:

> I know that several teachers have reported that their students are doing some amazing things on the Net, but at what cost? With that much money, you would think that we would have seen something a little more concrete. Like TAAS scores, they haven't gone up. SAT scores haven't gone up. Graduation rate hasn't gone up. What are these amazing new things, and why haven't they translated into higher scores?

Not all of the six teachers at the management stage were as openly skeptical; two in particular seemed to still be open to telecommunications potential if someone would show them. In fact, the one teacher said, "I still don't know. I haven't seen any real student learning beyond finding a few new sources; I think the jury is still out." She continued that she "certainly would have to rethink her position if positive student learning outcomes were shown to her."

CBAM assumes a general linear model where teachers go though each successive stage. There are no accommodations for individuals who reject an innovation. Teachers at the management stage were the exception to a linear trend for all of the research questions. Teachers at this stage were so concerned with classroom management and instructional design issues that they restricted student use, in effect rejecting the

innovation for the time being. The management teachers' decision to restrict student access was based on their experiences using telecommunications. They had seen that it was possible to access inappropriate material that included sites that contained adult material, sites with inaccurate scientific information, and sites designed purely for entertainment. They had personal experience with the amount of time that telecommunications often takes to learn. In short, they had experience with telecommunications and had made a conscious decision *not* to use it in their classroom with their students.

Limitations

This study, like all others, has some limitations. Some of the limitations of this study include the restricted population, one-time interviews, and dependence upon self-reported data. A longitudinal study of the population is warranted to monitor teachers' concerns over a longer time span, especially in light of the fact that telecommunications represent a changing innovation. Additionally, teachers were not asked about specific requirements to take the next step in implementing telecommunications. They were simply asked for supporting conditions. A long-term study would allow collection of data from participants as they were transitioning from one stage to another. This might also identify individuals for case-studies who were transitioning from one stage to another. All the data in the study was a result of teacher self-reporting. Self-reported data has been found to be less reliable that observational data. Specifically, independent observations of teacher use, student use, and reported positive effects of telecommunications on instruction and student learning would enhance any conclusions drawn from this study.

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For a complete description of the study, please refer to http://www2.gasou.edu:80/facstaff/sslough/dissertation/contents.html.

A Student Model for Representing Learning Process, Based on TMS Framework

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Abstract: Although the student model which is an important composite module to distinguish ITS from CAI has been developed until today, this model can be classified into overlay model and perturbation model, as the basic paradigm. These models have mutually a complementary relationship, and the abilities are not always powerful because they manage only individual learning items for understanding contents. In this paper, we propose a progressive student model to manage learning items effectively with a view to making error-diagnosis/detection mechanism successful and making up effective schedules of learning processes personally. The basic idea is derived from TMS framework. Our objective is to represent understood/mis-understood situation of student under consistently unified relationship.

1. Introduction

ITS (Intelligent Tutoring System) or ICAI (Intelligent Computer Aided Instruction) is investigated with a view to instructing individual students personally. In order to attain this subject, the student model is introduced as a most important module in comparison with the traditional CAI. It is necessary for the student model to represent understanding level or learning situation of student individually, and assist the instruction process to be next expanded in accordance with past learning history and understanding level (Kopec et al. 1992). The most basic function of student model is to manage sufficiently the information about which learning items are learned, which learning items are already understood, and which learning items are not yet understood. Thus, until today, two typical classes of student models were proposed: overlay model and perturbation model.

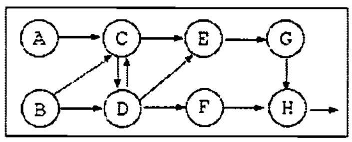
The overlay model manages learning items which students could understand one by one, while the perturbation model does learning items which students could not understand or mis-understood. These models have mutually a complementary relationship for representing the understanding level of student, and also the representative abilities are not always powerful because they have only individual learning items for understanding contents. Additionally, they are not successful to infer dependency among learning items, diagnose mis-understanding of learning items and detect the original causes for wrong comprehension. Namely, they are in short of the representation for management/control mechanism of dependency relationships among related learning items.

In this paper, we propose a progressive student model to represent the learning process by inductive relationship among learning items effectively. The basic idea is conveniently derived from TMS (Truth Maintenance System) framework, proposed by (Doyle 1979). In TMS, the world is always maintained truely so that the denotation relationships among currently accommodated terms should be believed interpretatively. If any contradiction were suddenly found among interrelated terms, TMS reorganizes the belief relationship of interrelated terms so as to make consistent interpretation possible. This mechanism is useful to manage the successful dependency relationships among already understood learning items and next instructing learning items. Of course, in our objective the subject to be maintained is different from that in TMS, and the mechanism is not the same as that in TMS. In comparison with TMS, our interpretation is grown up/down sequently by instructing new learning items.

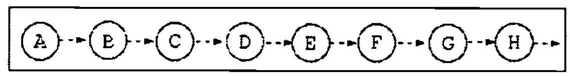
Our objective is to maintain understood/mis-understood learning items under consistently unified relationship among already instructed learning items, and manage the learning process and understanding level of student successfully in accordance with their actions/reactions. In order to attain this objective two new justifications such as CR (Correct) and WR (Wrong) are introduced in points of specifying the historical dependency relationships among derivedly acquired learning items and previously understood learning items and recording the cause-effect relationship among understood/mis-understood learning items, respectively, in place of two justifications SL (Support-list) and CP (Conditional-proof) in TMS. Using two different justifications, our student model can represent the understood/mis-understood situation among individual learning items and inferable relationship among derived learning items. In this paper, we address such a student model useful to diagnose errors and detect the causes. Additionally, we discuss these mechanisms on LISP tutoring system.

2. Framework

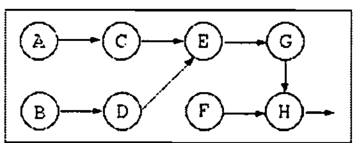
It is important for tutoring system to instruct learning items to student in accordance with his understanding level or learning situation or act/react to the learning process of student timely and smartly. In order to satisfy this requirement, the tutoring system must grasp the successive learning process. Thus, it is so necessary that the student model should represent the historical interrelation among individual learning items, which student has ever learned, in addition to the specification for understanding level of individual learning items, which were applied in the traditional student models. So, individual learning items have mutual dependencies: one learning item to be newly learned is derivedly composed of some other learning items which have been already learned as the prerequisite terms. Of course, these dependencies among learning items are implicitly predefined in the authoring text, as domain knowledge for learning items. In many cases, the student model can be organized under the mapping from the authoring text (Ohnuma et al. 1997) (Watanabe et al. 1993) and (Watanabe et al. 1993).



(a) authoring text



(b) construct in traditional student model



(c) construct in our student model

Figure 1: Construct in student model for authoring text

Figure 1 shows such a mapping. In Figure 1(b), the mapping moves only learning items, associated individually with some evaluated score values, into the student model from the authoring text; In Figure 1(c), the mapping transforms the learning items with dependency relationships into the student model, as a subgraph. The former was applied in the traditional student model, while the latter is organized in our student model.

In our framework, the student model is designed under the following viewpoints:

1) to keep historical information about successive learning items;
2) to support recovery mechanism for understanding errors;
3) to keep historical information about understanding errors;
4) to maintain understanding level of student inferably;
5) to indicate learning process of student explicitly.

Although the viewpoints 1) and 5) may be supported even by the ordinary overlay model and the viewpoint 3) may be done by perturbation model, our framework is more progressive. With a view to attaining these viewpoints the truth maintenance mechanism in TMS is very useful to our student model.

In TMS, individual terms are composed basically under the dependency relationships for other terms, and are justified with the relationships. If the contradiction among already accommodated terms is occurred, TMS establishes uniform belief interpretation among all terms with respect to the resolution of contradiction. This mechanism is adaptable to our viewpoints 1), 2) and 4).

In our student model, the system configuration is illustrated in Figure2. The error-diagnosis/detection module and instruction module for LISP program interact with the student model module and refer to the student record directly in order to identify the error statement (or function) or select the next learning item from authoring text. Of course, our student model module manages the historical understanding information of student so as to indicate current situation for understood learning items or not yet understood learning items under the relationship for the previously instructed learning items.

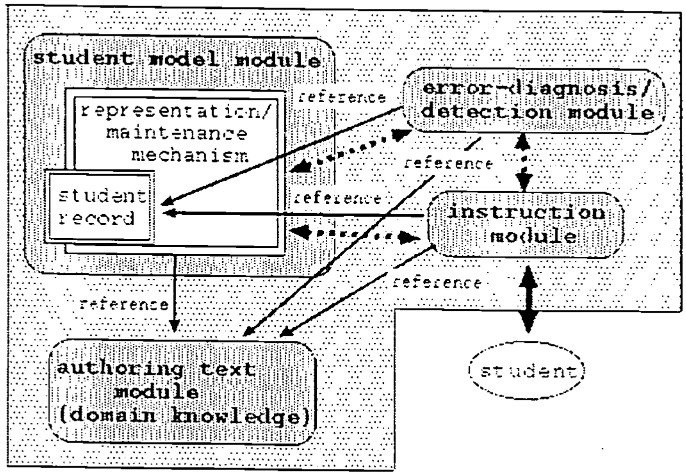


Figure 2: System configuration

3. Representation Form in Student Model

Our student model is fundamentally organized on the basis of truth maintenance mechanism in TMS. Of course, our objective is to manage the learning process of each student with respect to information about how student has learned, what he could understand, what he could not understand, which errors or mis-understanding terms he has until now.

We introduce two different forms for representing understanding level of student: CR justification form and WR justification form. CR justification form is as follows:

(CR (<in-list>)(<out-list>))

This justification indicates that when terms in <in-list> are "in-belief" and terms in <out-list> are "out-belief" this phrase is "in-belief". Namely, this justification represents inferably that the learning item for this phrase was understood by student. Here, "in-belief" means that the phrase is believed currently, like the concept of "in-belief" in TMS, and "out-belief" does that the phrase is not believed now. For example, consider the learning process, shown in Figure 3. Figure 3 shows a dependency graph with respect to the relationship among individual learning items. In this case, we can represent our historical understanding record for justification forms, as shown in Figure 4.

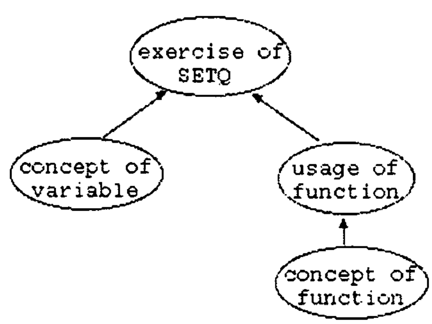


Figure 3: Sequence of learning items

Term	Learning item	Justification	Belief
N1	concept of variable	(CR()())	in
N2	concept of function	(CR()())	in
N3	usage of function	(CR(N2)())	in
N4	exercise of SETQ	(CR(N1,N3)())	in

Figure 4: Representation of learning process (1)

On the other hand, WR justification is as follows:

(WR (<term>)(<in-list>)(<out-list>))

This justification indicates that this term was understood wrongly when terms in <in-list> are "in-belief" and terms in <out-list> are "out-belief". For example, in the previous example WR justification is generated when the term N4 is "out-belief" (it is infered when SETQ was not understood correctly). In this case, our historical understanding record represents a set of terms in Figure 5. In Figure 5, the term N5 which was inserted into <out-list> of term N3 with "(CR (N2)(N5))" and term N4 with "(CR (N1,N3)(N5))" represents the cause that terms N3 and N4 are changed from "in-belief" to "out-belief". Also, the term N5 is generated, using the information that errors were found out for exercise of SETQ: the fact that the term N3 is the cause for term N4 is transferred from the error-diagnosis/detection module. Of course, when errors depend on several terms, <out-list> in WR accommodates every error cause: Figure 6 shows that the causes for term N4 depend on two learning items: term N1 and N3.

Term	Learning item	Justification	Belief
N1	concept of variable	(CR()())	in
N2	concept of function	(CR()())	in
N3	usage of function	(CR(N2)(N5))	out
N4	exercise of SETQ	(CR(N1,N3)(N5))	out
N5	nogood (error of N3 for N4)	(WR(N4)()(N3))	in

Figure 5: Representation of learning process (2)

Term	Learning item	Justification	Belief
N1	concept of variable	(CR()(N5))	out
N2	concept of function	(CR()())	in
N3	usage of function	(CR(N2)(N5))	out
N4	exercise of SETQ	(CR(N1,N3)(N5))	out
N5	nogood (error of N1 and N3 for N4)	(WR(N4)()(N1,N3))	in

Figure 6: Representation of learning process (3)

4. Maintenance Mechanism in Student Model

CR and WR justifications indicate that the corresponding learning items could or could not be understood correctly in accordance with the diagnosis result, respectively. In this section, we focus on the instruction strategy based on this student model. This topic makes our student model mechanism clear and makes the representation means of our two different justifications successful.

Term	Learning item	Justification	Belief				
			Stage1	Stage2	Stage3	Stage4	Stage5
N1	concept of variable	(CR()(N5))	out	in	in	in	in
N2	concept of function	(CR()())	in	in	in	in	in
N3	usage of function	(CR(N2)(N5))	out	out	in	in	in
N4	exercise of SETQ	(CR(N1,N3)(N5))	out	out	out	out	in
N5	nogood (error of N1 and N3 for N4)	(WR(N4)()(N1,N3))	in	in	in	out	out

Figure 7: Representation of learning process (4)

Figure 7 shows the transitional stages of belief values by re-instruction strategy for Figure 6. Thus, Stage1 as the initial stage is the same as that in Figure 6.

1) Stage1: (1) student cannot code function SETQ (term N4 is "out-belief").
(2) the cause depends on mis-understanding of concepts of variable and function (terms N1 and N3 are "out-belief").
2) Stage2: (1) re-instruct term N1 because of term N1 of <out-list> in term N5.
(2) by this, term N1 was understood correctly (term N1 changes from "out-belief" to "in-belief").
3) Stage3: (1) re-instruct term N3 because of term N3 of <out-list> in term N5.
(2) by this, term N3 was understood correctly (term N1 changes from "out-belief" to "in-belief").
4) Stage4: (1) erase error indication of term N5 for term N4 because terms N1 and N3 were understood (term N5 changes from "in-belief" to "out-belief").
5) Stage5: (1) re-instruct term N4, because term N5 was erased.
(2) by this, term N4 was understood correctly (term N4 changes from "out-belief" to "in-belief").

Here, the student model represents that all learning items for terms N1, N2, N3 and N4 were understood correctly. Namely, our student model points out that the instruction module should retry the learning items, contained in <in-list> and <out-list> of term "nogood" (error), and sets up the corresponding terms to "in-belief" after having learned re-instructed learning items correctly. This procedure is repeated until every learning item contained in <in-list> and <out-list> of term "nogood" have been re-instructed and understood.

5. Conclusion

We proposed a functional student model, based on the feature of TMS framework in this paper. Our student model not only represents understanding level or learning process of student but also contains historical learning information in comparison with the traditional student model such as overlay model and perturbation model. Additionally, under such feature our student model can indicate re-instruction strategy clearly with the cooperation among instruction module and error-diagnosis/detection module so as to maintain uniform interpretation of evaluation effects for learning items. Our framework is strong because the understanding maintenance mechanism which depends on the relationships among historical collection of learning items is effective.
As for our future work, the following issues must be investigated from a practical point of view:
1) application to large scale of learning items.
2) performance evaluation for understanding maintenance.

Acknowledgement

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Project-Based Collaborative Learning

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Abstract: This paper presents a project-based learning environment engaging inservice and preservice teachers in obtaining technology competencies. It summarizes the methods used to organize the collaborative learning group and the process of producing technology-related projects with instructional use in the various classroom settings. It also provides an analysis of the artifacts that were produced by the preservice teachers and the feedback from the school children and the inservice teachers involved in the project.

1. Introduction

The National Council for the Accreditation of Teacher Education} (NCATE) has developed technology standards stating that a prospective teacher should be educated in ``the use of computer and other technologies in instruction, assessment, and professional productivity." (NCATE, 1994). In the collaboration with NCATE, the {\em International Society for Technology and Education} (ISTE) established 13 guidelines for NCATE accreditation of educational computing and technology competencies for associated teacher education programs (ISTE, 1992). Many states have also required detailed competency requirements for each teacher education program in order to promote technology use in the classroom. Although many organizations have determined their own lists of technology standards, there is no universal agreement on even a base set of standards (Fisher, M., 1997). This general lack of agreement creates difficulties in establishing effective instructional training programs, as well as in promoting effective practice environments in the preparation of preservice teachers. In most cases, teacher education programs require two or three hours of technology-related coursework for each teacher candidate. Even so, the value so provided by such coursework is as variable as the available technologies in the offering institutions.

Cognitive psychology has contributed the idea that the mind actively constructs its own interpretations of information and draws inferences from them" (Wittrock, 1990, p.348). Based on this belief, the constructivist perspective describes learning as a change in meaning constructed from experience. According to constructivism, "learning is determined by the interplay among students' existing knowledge, the social context, and the problem to be solved. Instruction refers to providing students with collaborative situations in which they have both the means and the opportunity to construct" (Newby, T. J., Stepich, D. A., Lehman, J. D. and Russell, J. D. 1996, p. 34).

Project-based learning has shown some merits in terms of student learning because the very act of completing a project requires the students to engage themselves in a complex process of inquiry and design. The result can be thought of as an artifact, a product that can be shared and critiqued (Guzdial, 1998). Furthermore, the completion of a project ideally provides opportunities for cooperative learning among students and collaborative learning between students and more experienced professionals with expertise in specific areas.

Cognitive science has also shown that learning improves when skills and knowledge are explicit (Brown, Bransford, Ferrara, and Campione 1983). The processes involved in project-based learning have such features, often having well-explained goals set for students as well as explicit descriptions of the required skills. We have learned, however, through years of experience, that many skills and forms of knowledge can be deeply embedded within given educational experiences, and projects provide the best available method to help students learn these embedded or non-decomposable skills and knowledge.

2. Project-Based Learning -- an Example

An instructive example of project-based learning through collaboration between preservice teachers and inservice teachers took place in a town in Nebraska where students enrolled in a college technology course

required of education majors at Concordia College (now Concordia University) were matched one-on-one with classroom teachers in a K-8 elementary school and in a nearby high school.

2.1 Course Format and Rationale

The criteria used to match preservice teachers with inservice teachers consisted of their emphasized areas and their preferred grade levels. One of the learning processes was for these students (preservice teachers) to produce disciplinary-based ({\em e.g.}, history, social studies, mathematics, {\em etc.}) multimedia instructional material using a multimedia application available at both the college as well as at the elementary (in the case of elementary education students) or at the high school (in the case of secondary education students). Each preservice teacher was matched with one inservice teacher. The preservice teachers were required to make three contacts with the designated inservice teacher: first to discuss the theme of the project and to locate relevant printed material; next to show the first draft of the project and solicit suggestions for modifications; and lastly to submit the final product as part of the final project evaluation. It was made very clear that the collaborative project was part of their learning experience and that the final product -- the {\em artifact} would be factored into their academic performances for this course. At first they expressed reservations about the setting and the requirements, and some even complained about the lack of time to make meaningful contacts or to visit the classroom. As they became more aware of the ramifications of the project, they warmed to the concept. In addition, the Education Department at Concordia College was very supportive of the project and decided to appoint one of the faculty members to be in charge of recruiting inservice teachers to participate in the collaboration.

2.2 Recruitment of Inservice Teachers

Recruitment of the inservice teachers as mentors often turns out to be a difficult process. The main reasons are that schools lack necessary computer technologies and that inservice teachers are often not sufficiently competent in implementing instructional technology in their own classrooms, nor are they confident to make what they feel are significant contributions to the collaboration.

Another common concern is the time required of the inservice teachers. If viewed simply as an addition to their normal load weight, it would be virtually impossible to find willing participants. The course instructor can facilitate the recruitment of inservice teachers by emphasizing the mutual benefit for all parties to be gained by the project-based collaboration. The role of inservice teachers is, of course, is to bring their rich classroom experience to bear on the collaborative project, helping to smooth the transition for the preservice teachers as they try to apply classroom knowledge to classroom teaching. However, they need to be made to feel that they are supported throughout by the course instructors, and that the collaboration is between them and the course instructor as well as between them and the preservice teachers.

Fortunately, most inservice teachers approached for the present project were very enthusiastic about the collaboration, especially after they were apprised of the mutual benefits of the cooperative project. In turn, each student enrolled in the course was provided with one inservice teacher in their designated subject area and the grade level. The tangible benefits extracted from such experiences clearly indicates that those primary/secondary schools strategically located relative the education institutes need to be more active in seeking out (rather than simply responding to) opportunities to engage in collaborative experiences with preservice teachers.

2.3 Communication among the Participants

The course instructor's primary role in the project, apart from the final evaluation of the preservice teachers' projects is as a liaison between the preservice and inservice teachers. However, after the initial matching of preservice teachers with inservice teachers, the initiative shifts to the preservice teachers to maintain contact with their mentors. Even before the first meeting with the inservice teacher, the preservice teachers need to have drafted a rough outline of the proposed instructional materials, as well as a general strategy for piecing together the various multimedia components. Thus the first meeting can be devoted to a reconciliation of the preservice teacher's aspirations against the inservice teacher's resources and expertise. Note that even in those cases where the inservice teacher's technological expertise might even be below that of the preservice teacher's, the inservice teacher's experience in developing discipline-based curricula will be crucial to the collaboration. Once the

inservice teacher feels that he/she has the necessary components of the instructional materials, the "programming" stage begins, where the technology becomes a medium through which the curriculum is delivered.

Once a draft of the multimedia package has been prepared, a second meeting with the inservice teacher is scheduled, where it is expected that the inservice teacher will once again be a valuable resource in critiquing the curriculum. Based on the result of this meeting, the preservice teacher will prepare a final draft of the multimedia-based curriculum, to be evaluated by the inservice teacher during the last meeting, and then later by the course instructor. Ideally, the final product is a curriculum enhanced by modern technology so as to be assimilated by a greater number of students and to a greater depth. If this ideal is met, then not only will the preservice teacher have developed materials that will likely eventually be used in the classroom, but also the inservice teacher is apt to be willing to test the curriculum in his/her own classroom, especially since he/she already had a hand in its development. Fortunately, this ideal was frequently realized in the present project, resulting in a number of newly developed instructional materials.

3. The Final Product

The artifact of project-based learning provides a focus for review and reflection. Projects have a context associated with them, and in the present case the resulting artifacts can be used for teaching as part of the instructional material. This greatly raises the level of relevance to the preservice teachers; indeed, more than being mere ``dress rehearsals," these finished products are likely to eventually be used in real classroom settings. Two very important secondary effects were the elevation of the students' appreciation of the role and utility of collaborative-based projects, and the improved attitudes toward technology implementation. With the preservice students having assumed the primary responsibility for keeping the collaboration active, there was an obvious sense of ownership of the final project. More than 80\% of the preservice teachers discussed in their journals not only how much they valued the exchange in working with the inservice teachers, but also their appreciation in gaining valuable classroom practice.

Many of the inservice teachers openly demonstrated their enthusiasm for the project; some of them took the extra effort to arrange times for preservice teachers to work directly with the K-12 students, thereby providing a tangible environment within which to use those instructional materials that they were developing; others brought school children to the computer lab to teach them skills in using the multimedia applications developed by the preservice teachers. As a result, a significant number of the inservice teachers thought enough of the collaborative project that they viewed their interactions with the preservice teachers not so much in terms of professional altruism as in terms of professional development and a sense that a tangible contribution to teacher education was being realized.

4. Conclusions

The above-mentioned project underscores the possibility of harmonizing teacher training for preservice teachers and professional development for inservice teachers in a mutually reinforcing environment. However, preparing our preservice teachers with the knowledge and skills necessary to integrate technology into the classroom continues to be a challenge for all teacher educators. Most of our preservice teachers are traditional students who have little to no classroom teaching experience, and it is understandably difficult for them to make the connection between what they are learning in the technology course and real classroom implementation. While organizations have attempted to establish various guidelines and standards for teacher education programs as they relate to technology competency, very few studies detailing the efficacy of technology-related coursework in such programs are available. Requiring credit hours with no detailed standardized competencies does not assist in the quality preparation of teachers. Most teacher-educators are still struggling to identify the most efficient format and practical strategies to better prepare our preservice teachers for classroom practice in today's Information Age within the framework of the general requirements set forth by the accreditation organizations and teaching institutions. On the other hand, in spite of the many efforts on the part of professional educators to bring more technology into classroom teaching and learning, there are schools where teachers use very little technology in their instruction due to lack of facilities or lack of training or support from

administrators at various levels. However, as the present study argues, with only a modicum of technological facilities, a collaboration between preservice and inservice teachers can be initiated with a common goal to share in this country's ``technology-transfer" initiative; seen in this way, the benefits to both groups become manifest.

Finally, and most importantly, the purpose of involving inservice teachers as mentors to preservice teachers in project-based learning was to seek more opportunities for authentic learning environments for preservice teachers and to reinforce inservice teachers' move to integrate technology into their own classroom instruction. After two semesters of such practice, a model emerged on the basis of which a formal proposal to require all preservice teachers enrolled in the corresponding technology course to engage in similar collaborative work with inservice teachers. This model continues to provide tangible training for the preservice teachers and, of equal importance, provides continual reinforcement for the inservice teachers to continue and expand classroom use of technology. The above project, now an ongoing one, continues to show great promise. However, this and similar models will continue to require further research and analysis.

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YOUNG CHILD

1993

Technology, Creativity and The Young Child

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Introduction

An assumption can be made, based on its evolution during the past 20 years, that technology will play an instrumental role in the future. How technology is used by today's students, especially in the classroom, will affect the students' perspective on the function of technology. Is technology used as a digital worksheet, as a game source, or as a way to extend student thinking and learning? The ultimate goal of schools and classroom teachers should be to help students develop the ability to think and act creatively when using technology. How may this goal be accomplished? The following discourse offers suggestions on what to look for in software and how to use technology to promote creative thinking.

Selection and Utilization of Software

"The most critical decision a teacher can make is that of software selection. After all, a computer is little more than plastic and electronic circuitry until the software is loaded" (Shade, 1996, p.17). Initially, there are three primary areas to be examined when evaluating software. They include child features, teacher features and technical features. Child features relate to the focus of developmentally appropriate physical aspects of the software. In other words, are the physical and mental capabilities of the child matched to the software or are additional prerequisite skills required? Teacher features incorporate the design functions of the software that include instructions, documentation, supplemental activities, and ideas for integrating the software into the curriculum. Technical features combine all elements of a program such as color, sound, and motion. They are designed so that the program can be operated effectively by the user. Following examination of these features both general and specific guidelines for the selection and utilization of software programs should be addressed.

General Guidelines

Selection of software requires pre-planning and preparation by the teacher. This approach is sometimes considered time consuming. Goals and objectives that foster creativity and allow time for exploration of the software should be built into any activities that are planned. Software should not be selected as a reward for good behavior. Research has shown that when software is selected as a reward it reduces creativity.

Software should be selected as a tool in conjunction with other materials and activities. When selecting software, following an assessment of the intended learners and required prerequisite skills, the emphasis on attaining stated learning goals and objectives is important. Following the selection of goals and objectives,

the documentation and software program should be completely reviewed before it is used with students in the classroom.

Specific Guidelines

Software programs should be evaluated using criteria that include program characteristics, content, usage, and technical aspects. Program characteristics relate to the subject matter, grade or age level, number of users, type of programs (drill and practice, tutorial, simulation, etc.) Appropriate consideration of the program characteristics is important. Normally, software, especially commercial software, has been designed to appeal to multiple age or grade levels. Additionally, there is also a trend toward incorporating several content areas within a single package that may or may not be relevant for the age or grade level. The content should reflect accurate and up-to-date information that is organized, presented effectively, and complies with the district curriculum and is free of bias and stereotypes. Appropriate vocabulary, spelling and grammar are also considered part of content evaluation. Vocabulary should reflect the designated grade or age level as stated in the software program and refrain from the use of stereotypes, bias and slang. Usage focuses on clear and understandable instructions for teachers and students. Help screens, interaction with appropriate feedback and reinforcement, self pacing features and a range of skill levels that include branching should also be evaluated when considering the usage of a software program. Technical considerations for evaluating software programs should reflect appropriate screen design. It is important that software incorporate screens that can be easily seen, graphics and color that are age appropriate, sound and motion that run smoothly without glitches or an excessive amount of manipulation. The screen design should also include icons that clearly indicate what the user is expected to do when a specific icon is selected.

While the above mentioned criteria are vital considerations when software is being selected, they alone do not provide for a challenging atmosphere to encourage spontaneity and inspire creativity. The selection process should focus on alternative ways that software may be used. The alternative approaches would foster exploration of the what "if" possibilities relating to specific software that would help foster the creative process.

Learning Opportunities

Learning opportunities emphasizing the creative process need to promote creative thinking. Creative thinking involves an individual exploring a problem, making associations between the current situation and prior experiences, evaluating the situation in order to respond to it, and generating a unique solution to the problem (Hubbard, 1996; Isenberg & Jalongo, 1997). To encourage creativity, these four actions are considered when a teacher plans learning opportunities incorporating software. Mentally engaging the students by having them plan and make decisions to solve a problem is a key step when designing such learning opportunities. Select problems relevant to the learners where the use of technology facilitates and extends thought. The selected software may allow the students to create scenarios or provide information in order to problem solve. Learners are encouraged to use knowledge and skills across curriculum areas within the activities. Integration across content areas enables students to see how knowledge and skills are meaningful, useful, and linked. Essentially, the students should utilize and apply what they have learned to approach and solve problems. Learning opportunities are planned where students collaborate and interact with one another to complete the task. Seeing other perspectives allows learners to experience alternative approaches, techniques, and strategies to solving problems. Cooperative learning also allows the exchange of ideas that can stimulate and clarify thinking. Involvement in the process and with the use of technology must be encouraged for every student. Open-ended learning opportunities are required where the students create the plan to follow and their decisions decide the final outcome, not the software. The promotion of fluent, flexible, and original thinking is highlighted so the students are able to actively learn, plan, decide, and problem solve using technology (NAEYC, 1996).

Conclusion

Technology should be utilized as a resource where an individual directs the technology to solve problems, to seek solutions. The use of technology in the classroom needs to be evaluated and when appropriate, modified to achieve this purpose. Students need to go beyond rote learning and practice or game playing. Technology should become the tool that enables learners to seek information, generate lots of ideas, and explore potential solutions as they decide how to solve problems. When used in such a way, technology encourages and stimulates creativity in the learner.

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Computer Applications for Preschoolers with Disabilities

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Abstract: There are many benefits to using computers in preschool classrooms. Research and experience indicate that assistive technologies which enable access to computers are of tremendous benefit for people with disabilities. It should be of some concern, therefore, that there is very little work reported in the area of assistive technology and computer use in preschools for young children with disabilities. Reasons for this include the unfamiliar set of skills associated both with computer use and assistive technologies. Another reason for lack of computer use with young children with disabilities could be lack of information relative to the distinct cognitive and physical prerequisites required for use of assistive technologies and computer use. This paper discusses the training issues which should be addressed when teaching preschool teachers of young children with disabilities to use computers as learning tools. Assistive technologies which are of particular use in preschool classrooms, issues surrounding developmentally appropriate software, and cognitive prerequisites for computer use are discussed.

Recent years have seen a dramatic increase in the availability of computer software for young children. Trend analysis in market research has shown that, recently, the largest area of software growth has been in new titles and companies serving the preschool market. (Haugland, 1997). Such issues as the desirability of computers in preschools and appropriateness of software have been addressed in the preschool literature. The arena in which young children have the most to gain from early computer use is, however, relatively unexplored. This arena is computer based early educational interventions for young children with disabilities. This paper explores what the literature has to say about young children using computers and the special factors one must consider when planning to use computers with young children with disabilities. Attention is given, also, to the specific skills preschool teachers of young children with disabilities must have in order to use computers for the maximum educational benefit possible.

In general, the considerations surrounding computer use with preschoolers are the same whether we are considering young children with disabilities or typically developing youngsters. All children, two through six years of age, learn from exploring their environments and interacting with other children. Early concerns regarding the desirability and applicability of computers with young children centered primarily among constructivist thinkers who noted that young children need sensori-motor and concrete experiences in order to learn from their environments. Specifically there were concerns that computer use in preschool classrooms might socially isolate children (Barnes and Hill, 1983), and squelch creativity (Pardeck, 1986). Elkind (1987) maintained that children should reach the level of "concrete operations" (around the age of seven) before attempting to use the more abstract dimensions of a computer screen. Although there are many questions left unanswered about preschool computer use, research is beginning to suggest that the concerns expressed in the 1980's and early 1990's are unfounded.

Recent research in computer use with young children has resulted in some optimistic conclusions. Initial studies confirm that computer environments with concrete manipulable events teach pre-mathematics skills as well as interactions with traditional concrete objects. (Clements, Natasi, and Swaminathan, 1993). Furthermore, research continues to provide overwhelming evidence that pre-school children prefer to socialize around a computer than play with it alone. (Clements and Nastasi, 1992). Even children who tend to be social isolates tend to socialize more when playing with a computer. (Clements, 1994). The question of whether computers are appropriate in preschool classrooms has been answered. The remaining questions regarding preschool computer use (aside from training for teachers) are questions of developmental appropriateness and access for all children.

Assistive technologies, input and output devices that enable alternative access to computers, have changed the face of education and training for people with disabilities dramatically. Remarkable and sophisticated assistive technology devices exist which enable people to communicate with computers via eye gaze, breath, or a neck movement. Computer output devices can now speak text, print in braille, and enlarge portions of a screen. Despite the existence

of these devices, and despite universal agreement that very early intervention in the lives of young children with disabilities is critical to development, there is little work reported in the literature which extends the use of technology into preschool classrooms for children with disabilities. None of the studies referenced previously in this paper involved young children with disabilities. Two notable exceptions exist to the seeming lack of interest in the literature; the "Macomb Projects" and Project ACTT (Activating Children Through Technology), both at Western Illinois University, have contributed greatly to the body of knowledge regarding early switch use and computer applications for very young children with severe disabilities (Huntinger, 1994).

One can only speculate as to why tools which have proven so useful in the education of school-age children and adults with disabilities remain curiously unexplored in the preschool arena. Educational services for preschoolers were not mandated until 1986 when the "Education of the Handicapped Act Amendments" were passed. Early efforts on behalf of young children with disabilities focused upon the cultural institutionalization of early intervention programs. Such new methodologies as computer use in preschool classrooms, which require considerable resources and teacher training, have not received the attention that such critical issues as service delivery and interdisciplinary collaboration, family focused intervention, and inclusion with typically developing peers have received. Another factor which might contribute to lack of attention to computer use with preschoolers is the "unfamiliar" and "challenging" set of new skills which preschool teachers must learn in order to use computers as learning tools. (Huntinger, 1994.) Although all of these factors may be involved in the lack of focus on computer use for preschoolers with disabilities, there are other training needs of teachers which should be considered, namely: complex cognitive prerequisites which enable young children to both use and benefit from computer use, and the level and developmental appropriateness of commercial software.

During the Spring of 1998, a project sponsored by the "Louisiana Educational Quality Support Fund" and awarded to Northwestern State University of Louisiana, enabled the training of approximately 100 preschool teachers of children with disabilities in computer use in their classrooms. Prior to the workshops, teachers were asked to complete a "needs assessment" in order to determine which areas of training in computer use they felt would be most useful. Participants were asked to rank order 4 possible training areas including installing software, using assistive technology devices, identifying developmentally appropriate software, and using the internet. Surprisingly, almost all of the participants gave equal ranking and importance to all four topics. In order to address all 4 training needs, mini work-stations, manned by one or two trainers, were set up to accommodate no more than 4 participants at a time. Workshops lasted 6 hours and were limited to a maximum of twenty five teachers. Teachers rotated among the work stations and received training in the four areas mentioned previously.

During the workshops, in addition to technical training in software installation, assistive technology devices, preschool software, and use of the internet, participants were asked to consider several issues. Among them; the types of assistive technology devices which will encourage full student participation, a system for teaching cause and effect relative to software use, and the cognitive and language development levels of the children in their classrooms. Teachers should have a system for evaluating whether or not software is "developmentally appropriate" and whether it matches and will enhance the cognitive and language levels of the children interacting with the software. Each of these issues is discussed in subsequent sections of this paper.

Although many adaptive input devices exist, there are several which are particularly useful for preschoolers with disabilities. Many preschoolers (including children without disabilities) have not developed the fine and gross motor skills required for standard keyboard or mouse manipulation. Other children who benefit from adaptive input devices include children with fine and/or gross motor delays, children with upper torso physical disabilities, children with vision and/or hearing impairments and children with severe or moderate cognitive deficits. When children are not able to use a standard keyboard or mouse several adaptations which allow computer access are possible. These include modifications of standard keyboards, alternative styles of keyboards, and use of single switch devices. Standard keyboard modifications could include headsticks, mouthsticks, locks for selected keys, and speed enhancement. Alternative keyboards include such devices as touch windows (touch screens), PowerPads, IntelliKeys, or Muppet Learning Keys. Single switch devices allow input via a light touch of hand, foot, head, voice or breath and must be connected to a computer interface box. Many preschool teachers prefer the use of alternative keyboards to keyboard modifications.

"Touch windows" are popular items with many preschool teachers and students. Touch windows can be placed on a computer monitor and will allow direct activation of programs by a touch on the screen. PowerPads and Intellikeys both include a board which is attached to the computer and overlays which are placed on the board thus allowing children to perform many activities such as turning pages, selecting answers, etc. Both devices are somewhat less useful currently than touch screens due to the special training a teacher must receive in order to use these peripherals. They can, however, be of great benefit to children who should make a transition to mouse use. The reason

they can assist in making the transition to mouse use is that a child must understand that a device which is being manipulated adjacent to a computer will actually produce results on the screen. And, more importantly, that where one touches the peripheral will create distinctions in what occurs on the screen. These cause/effect associations (sometimes referred to as contingency awareness) are important prerequisites to successful mouse use but may not be learned automatically by some children with disabilities.

One of the most powerful tools for young children with disabilities is a single switch input device. There are many different styles of switches including big red round switches, button sized switches activated by minute muscle movement, and tread switches which may be activated by stepping on a top plate. Preschool teachers who use switches in their classrooms tend to prefer the larger round versions although switch use should be determined by the physical strengths and needs of a child.

Some young children with disabilities are not prepared cognitively for computer use despite modifications to the computer. The cognitive prerequisites for computer use have not been studied to any great degree and most of the information available to us comes from observations of young children and teachers attempting to use computers for the first time. Although some children may be able to hit a switch and produce a result on the screen, they do not seem to understand that they are the agent and that the result may be duplicated. Simple random practice with the computer does not teach some children contingency awareness. For these children (frequently with severe and/or multiple disabilities) it is most appropriate to teach switch use with items such as toys and music. Children should be taught that they can activate an item or action, through switch use, to obtain desired results. When children learn this, given the necessary assistive technologies, they are ready to use computers.

The Early Communication Process Using Microswitch Technology (Rowland, D. & Schweigert, P., 1993) describes a series of procedures an early intervention teacher may use to teach a child with severe and/or multiple disabilities how to use switches. Specifically, the recommended procedures describe how to teach a child to use a switch to gain attention, make requests and express interests, make and express choices, and, finally, to use symbols to express preferences. These important components of language development also may be considered prerequisites to successful computer use for young children.

Finally, any preschool teacher must consider whether software is "developmentally appropriate." The term "developmentally appropriate" is widely used in preschool literature to describe procedures and practices which are appropriate for use with young children. In *Developmentally Appropriate Practice,* Bredecamp (1986), enumerated the practices recommended by the NAEYC for the education of young children. Age appropriateness, child initiated activity, and concrete and manipulable activities all are important components of developmentally appropriate practice. These components should characterize preschool software. In a complete review of preschool software, Haugland (1997) states " [of] approximately 750 software programs being marketed for use by young children ... about 20% of the software meets young children's developmental needs" (p. 26). In the same review, Haugland presents the "Haugland/Shade Developmental Scale - Revised Edition" (p.27) which is a resource preschool teachers may use to evaluate the developmental appropriateness of software.

Computers in preschool classrooms are becoming a common sight. Evidence exists which supports the notion that computers can be very useful in the education of young children. The potential of computer use with young children with disabilities is enormous but has yet to be realized. When early intervention teachers receive the training they need in early switch use, assistive technologies, and software selection, computers may, indeed, prove to be the tools which transform potential into reality in the lives of young children with disabilities.

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Early Childhood Development:
The Saga Continues

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Abstract: Technology skills standards at the local, state, and national levels may serve as an adequate yardstick for satisfying set requirements; yet, they have another useful purpose. A careful selection and testing of those skills through a progressive demonstration by third grade subjects reveals how an individual school might adjust its own approach to technology at every grade level, thus, tailoring its own guidelines and satisfying standards. This paper describes the development of two instruments which measure and assess young children's computing skills and related learning needs.

The Early Childhood Development Center (ECDC) School at Texas A&M University – Corpus Christi (TAMU-CC) affords unique and ongoing opportunities to document and research uses of technology by young children and their teachers. The ECDC presently serves over 100 three-year-old through third grade students. This discussion and ongoing research serve to first, examine an overview of teachers' backgrounds, approaches, and ideas on technology, then measure the degree to which a sample of the third graders can demonstrate skill proficiency.

Our search for standards began at the state level where students are uniformly tested in all disciplines. The Texas Essential Knowledge and Skills (TEKS) standards laid the foundation with only few variations from those standards required by the Corpus Christi Independent School District (CCISD) or those suggested by the International Society for Technology in Education's National Educational Technology Standards (NETS). For logistical purposes, we selected skills most readily demonstrated that test higher level skills, such as information acquisition and evaluation, and a few remedial skills expected of any third grader navigating about the personal computer.

The Pre-test Interview

Before proceeding with the testing of student subjects, we interviewed three teachers at the pre-K, kindergarten, and third grade levels asking general questions regarding training and technology integration. The survey (refer to Figure 1) provided the researchers with the teachers' perspective and a sense of direction for this study and studies to come.

Figure 1: Preview Survey

Instructor_____________
Grade level____________
Subject area____________
Date__________________

I. Phase 1 Topics introduced at the commencement of the teacher interview

a. Identification of project: An examination of technology and its integration at the pre-K through third grade levels at the Corpus Christi Independent School District Early Childhood Development Center.
b. Purpose: The immediate purpose is to develop measurement tools, beginning with the following pre-survey, an oral case study of three grades (pre-K, kindergarten, and third) to preclude a follow-up examination through written surveys and observation.
c. Results to: Texas A&M University – Corpus Christi College of Education; Dr. Stephen Rodriguez, Head of Educational Technology; Dr. Jane Wilhour, Director, & Mark Hughes, Principal, Early Childhood Development Center.

II. Phase II General questions

a. Identify hardware available in the classroom
b. Address its usefulness/uselessness
c. Could you provide a "wish list" for hardware?
d. Identify available software
e. What productivity software do you have or use?
f. Could you name some technology activities that work for you – gaming; simulation; tutorials?
g. Could you identify the useful/useless software products?
h. What would be your software "wish list"?
i. Do you have a home computer? It's format? For leisure or work?
j. Do you make use of the web in your classroom?

III. Phase III

Prior/current teacher technology training and support

a. Where (if any) did you receive your past technology training?
b. Was technology training or skills a prerequisite to ECDC instruction?
c. Does current training come from the district? School?
d. Is it curriculum integration or skills training?
e. Are you trained in web resources?
f. Who or what is your in – house (technical) support?
g. What are your other resources?
h. Could you make any training suggestion?

Teacher's assessment of own student skills and technology in the classroom

a. What are their previous skills?
b. What is their in-class skills training (time per day/week)?
c. What are the student attitudes?
d. Do computers serve as motivators?
e. How are skills assessed?
f. How are skills integrated into curriculum?
g. Could you make suggestions? - What works? What does not?

Survey Results

The survey was revealing for reasons outside of the skills standards evaluation. We unearthed unique observations of which only the classroom teacher could be aware. There were warnings about the dangerous mix of kindergartners and printers and suggestions for the practical such as washcloths and CD holders or a headset to accommodate the smaller heads of the pre-K future tech whizzes. We discovered glitches in software and received advice and evaluation of software and hardware. We also discovered that with teacher's guidance a three-year-old can maintain a portfolio of work – a useful tracking device for

monitoring throughout the ECDC. Common among the teachers was a desire for an in-house technologist to assist with supplemental lessons. Though equipped with ten iMacs and its accompanying software in a technology-conducive environment, teachers could use that extra guidance, particularly to help with the integration of technology into lessons.

Skills Testing

Our assessment measured students' computing skills as prescribed by three bodies of academic standards at the local, state, and national levels: Corpus Christi Independent School District (CCISD), Texas Essential Knowledge and Skills (TEKS), and International Society for Technology in Education's National Educational Technology Standards (NETS).

We developed an observation and interview checklist (See Figure 2) to guide us in assessing skills. To develop the instrument we selected third grade skills from a broad range of categories under the CCISD, TEKS, and NETS standards: Foundations, word processing/keyboarding, software/multimedia, and information acquisition. The testing followed a logical progression where the subject could answer some questions, open, perform, and close programs, then proceed to the higher order skills.

The degree to which the standards are met were measured as "ample" (4) where no suggestions were given as to how to proceed (for example, opening a write or paint program), "adequate" (3) which required a minimal suggestion or repetition of the command from the researchers, "meager" (2) where the skill is barely demonstrated and requires aid in navigation, and "inadequate" (1) in which the subject lacks knowledge, much less performance, of the skill in question. Figure 2 shows the checklist of the skills questions. Figure3 shows how the questions are posed to subjects.

Figure 2: Survey of Technology Skills

[Tested skills (*indicates review)] [Degree to which expectations are fulfilled] [Standards required by:]

Subject #	Ample 4	Adequate 3	Meager 2	Inadequate 1	CCISD	TEKS	NETS
Part I: Foundations							
Identify hardware components						X	
Explain input, processing, and output						X	
Discuss common uses of Technology in daily life							X
Part II: Word processing, keyboarding, & language skills							
Open word processing program					X		
Demonstrate proper keyboarding techniques					X	X	X
Proofread and correct errors					X	X	
Demonstrate adequate speed						X	
Name file*						X	
Save file*						X	
Print hard copy*						X	
Part III: Software & Multimedia							
Open and demonstrate proficiency in program with audio, video, or graphics					X		
Create original image*						X	

Briefly input information on a spreadsheet					X	X	X
Part IV: Information acquisition/ Telecommunications							
Open the Internet						X	X
Search and find a given subject						X	
Evaluate acquired information						X	X
Send an e-mail message					X		X
Properly shut down computer*						X	

Figure 3: Skills Questions

Part I: Foundations

- Pointing to various, visible hardware components, the subject must identify 4 devices.
- After confirming the identification of the input devices (mouse, keyboard), the CPU, and output devices (monitor, printer), the observer asks the subject to explain what happens when information is put into the computer.
- Ask the subject how and if the technology in the classroom may also be used at home, work, and everyday life.

Part II: Word processing, keyboarding, and language skills

- Ask the subject to write a brief (two to three sentences) description of self by opening a word processing program.
- Observe keyboarding techniques (proper use of alpha-numeric characters and function keys).
- Does the subject read work carefully and make corrections without being prompted by the observer?
- No specific WPM is demanded; however, the subject should demonstrate fluidity.
- Ask the subject to name and save the file, then print a hard copy.

Part III: Software and Multimedia

- Ask the subject to open a favorite multimedia program, follow the instructions, and demonstrate its proper use. The observer may select a program from the menu if no favorites are available.
- Using *Paint* or similar program, the user must draw, color, or compose an original image.
- Following the given directions, the subject must input any data into a spreadsheet application.

Part IV: Information acquisition/Telecommunications

- Ask the subject to open the Internet.
- Ask for the subject's favorite academic subject, person, hobby, or sport. The subject then must conduct a search on the subject by entering it on a search engine.
- Once the subject/site is located, the subject is to evaluate/comment on the found information.
- Using the previously-saved file or by creating a new one, the subject must send an e-mail message.
- After exiting the Internet, the subject properly shuts down the computer.

The Results

At this writing, we are only a few days shy of complete collection of the data. While most of the subjects have been tested, definitive conclusions are forthcoming by the end of the year. Meanwhile, the results currently reveal that while the majority of the subjects have "ample" to "adequate" foundations skills, most are lacking keyboarding skills. There is, of course, the question of environmental factors and whether the observer, by his very presence, impeded with the motor skill demonstration; nevertheless, it may be necessary to further examine these skills at the lower levels.

When it came to maneuvering the mouse for multimedia programs, the subjects seemed adept. Those familiar with the paint programs demonstrated ample creativity. There were those, however, who were surprisingly unfamiliar with creating a graphic. It seemed as though no students were comfortable on the Internet. Navigation required heavy guidance. A full report of our observations of third graders may be obtained by contacting the authors.

Until all the results are in, final analysis is pending. However, since sending email was one of the skills standards required by CCISD and NETS, rather than waiting for results that state the obvious lack of Internet prowess, we have scheduled a time to take advantage of the upcoming holiday season. Over the next few days, the subjects will send electronic Christmas cards, complete with animations and sound, to a neighboring school and/or parents. Having this much fun, it should be easier to start at the top of the skills list, and work our way back.

Closing thoughts

The ECDC School at Texas A&M – Corpus Christi offers a unique environment in which to consider young children's computing skills. This project entailed interviews of selected teachers and the development and application of an instrument to assess third-graders' computing skills. These activities are intended as a springboard into a sustained research effort in the student technology arena at the ECDC School.

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Computers, Kids, and Crayons: Looking at the emergent writing behaviors of kindergartners using technology

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Abstract: This paper presents the findings from a study that observed and documented a kindergarten community's writing as a response to literature and math activities. The study looked at the process, the behaviors, and the final products of these emergent writers. One of the foci was to observe and document the behaviors of the kindergartners as they composed using traditional writing materials and multimedia technology. The study provides insight into how these kindergartners transfer their assumptions about print between writing mediums and the implications these findings can have on early childhood educator's expectations and assessments of young children using technology.

Introduction

Researchers have questioned and debated the appropriateness of using computers with young children in early childhood classrooms (Barnes & Hill, 1983a; Brady & Hill, 1984; Bredekamp & Rosegrant, 1994; Davis & Shade, 1994; Papert, 1993; Walker, 1983) since the early 1980s. It appears now that the decision regarding the placement of computers in early childhood classrooms has been taken from the early childhood professionals. The Telecommunications Act of 1996 calls for every classroom to be on the information highway by the year 2000; in 1995, one-half of our schools had access to the Internet (Kantrowitz, 1996). In 1995, 5.5 million computers were already being used in K-12 schools (Creedy, 1995), one report estimates an average of one computer for every 35 students (Kantrowitz, 1996). Computers are in our schools now, which means they are in early childhood classrooms. Early childhood professionals need to start asking what happens with these computers that are in the early childhood classrooms, instead of it the computers should be in these early childhood classrooms.

The National Association for the Education of Young Children (NAEYC) issued a position statement (NAEYC, 1996) calling for the examination of the quality of technology and its developmentally appropriate use in early childhood programs. NAEYC's position statement addresses seven issues:

1. the teacher's role of evaluating the appropriate use of technology;
2. the potential benefits of technology to early childhood programs;
3. the integration of technology into the learning environment and curriculum;
4. the equal access of all children to technologies;
5. the software's portrayal of stereotypes and violence;
6. the advocacy for quality programs by teachers and parents; and professional development (p.11).

Throughout NAEYC's statement, they remind us that technology is not to be the curriculum, but part of an entire program. Children still need to work with paints, blocks, books, and the other traditional early childhood materials. Technology is an addition to, not a replacement for, these materials. Technology becomes another medium for exploration and meaning making. We need to look closely at how technology can best be used to support the development of the children using it just as we would examine any new addition to an early childhood environment. We also need to look at how the children's use of technology increases our knowledge of the ways children come to know and learn.

The Study

The study took place in a university laboratory school kindergarten from March through the middle of May. There were eight children enrolled class, three girls and five boys. The children's ages ranged from five years five months to six years two months. The children's literacy abilities ranged from those who were at the very beginning stages of recognizing and writing letters and numbers with little reading ability, to children who were transitioning into traditional spelling conventions and were fluent readers.

I served a dual role in this classroom, I was both the kindergarten teacher and the researcher in the study. This gave me the unique ability to look at the children with an understanding of what had happened prior in the classroom as well as what was being observed during the data collection period.

The computers had been available since the first day of kindergarten. Programs were chosen which encouraged autonomy in the children. By the time the study began the children had been using the computers for six months and were all comfortable in working with the computers. Most of the children knew how to start the computers, how to enter their own desktop area, how to access programs from their desktops, and how to print. Many of the children understood how to use programs that required compact disks (CDs) to operate, and could insert and remove the CDs. With a classroom philosophy of integrated curriculum, I felt strongly that the computers should not be in a lab setting. I also felt that to place all the computers in one area, creating a computer center, was in essence establishing a computer lab in the classroom. For this reason, all the computers were located on specially designed low carts. The computers could be moved to the center where the children wanted to use them.

Data collection happened primarily in the form of video taping. During the study, two of the computers were equipped with scan converters that fed the screen activity to video recorders. Three video cameras were used to tape the children engaged in activities through the room. The video cameras captured the children interacting while working traditional materials and at the computers. Some anecdotal notes were kept. These notes documented occasions when video taping was not an option. There were few times when there were not enough cameras to cover all the areas where the children had chosen to work. These notes included the date and description of the activity, who the children were and what they were doing, descriptions of the project, and conversations.

Another data source was the artifacts from the writing events. When children working at a computer exit a program from *KidDesk*, the final product was automatically saved. When the children exited other programs, they saved their own files, or asked assistance to save their file. However, data was not lost if files were not saved to the hard drive. Since all monitor activity was recorded onto videotapes, I could use a video capture program (*Snappy*) and print copies of any of the screens. This procedure was valuable, because it allowed me to retrieve some of the draft writing samples that had not been printed or saved. However, printing a hard copy is not an option for compositions containing sounds and movement. Again, the videotape created the data source for analysis. Items from the art table and traditional writing activities were either saved, photocopied, scanned, or photographed, depending upon which was appropriate and the individual student's wishes.

The videotapes and artifacts were examined looking for activity that fit into the categories described in Clay's "What did I write? Beginning writing behavior" (1975). The identified emergent writing activities were coded using these categories and separated into traditional and computer generated groups. This allowed for an easy comparison of the artifacts and incidents that fell into the same category using both mediums.

The coded data categories were:

Sign Concept: "The symbols stand for something else. The writing says something" (Schrader, 1990, p. 12). Had the child used the symbols as representations of their writing?

Flexibility Principle: "Letters are made up of a combination of features. Letters can be varied to produce new letters or to invent letters that do not exit" (Schrader, 1990, p. 12). The child can adapt what they know about letters to create Anew@ letters. Did the child play with letter forms, did they make up their own letters based upon what they knew about letters?

Generating Principle: "There is variety in the arrangement of symbols. They are repeated in different combinations" (Schrader, 1990, p. 12). I looked for examples of the children using the same symbols in different combinations, understanding that letters could be combined in different groupings, but not necessarily understanding the relationship between letters and sounds. Clay (1975, p. 27) says that if a child has command of only three signs that the child might produce a line of print like this. Another child beginning to understand the relationship to letters and words will generate a list of names simply by using the letters he knows and copying others.

Recurring Principle: "The same symbol is repeated many times in a string" (Schrader, 1990, p. 12). Did the child repeatedly use the same symbol when making a string of symbols? Did the child use the same stamp in the drawing programs, deliberately going back and making conscience choices to use that stamp? i.e.,

I like the kitten	or	ddddddddddddddd
I like the kitten		bbbbbbbbbbbbbbb
I like the kitten		&&&&&&&&&&&&&&&
I like the kitten		bbbbbbbbbbbbbbb.

Linear and Directional Principle: "Letter identification depends upon letter orientation. Letters are set in a pattern from left to right and top to bottom" (Schrader, 1990, p. 12). Did the child have trouble with orientation of the letters or knowing which direction to write from?

Page Arrangement: "Thought is given to how the words on the page are to be arranged" (Schrader, 1900, p. 12). Was there attention paid to where the child placed the text on the page?

Concept of a Word: "A string of letters represents a word. It may or may not be bounded by a space or a mark" (Schrader, 1990, p. 12). Had the letters been placed in their order with deliberation and thought toward a representation of speech.

Spaces Between Words: "Spaces or marks are used to indicate word boundaries" (Schrader, 1990, p. 12). Was there a consistency in the amount of space used between letters and words? Was there an obvious difference in this space, with more space being between words.

Inventory Principle: "All known words that can be produced are written. They do not convey a message" (Schrader, 1990, p. 12). Did the child write lists of words? Did they use words to label the words on the page, instead of writing sentences?

Punctuation or Signs: "Punctuation marks and/or signs are used as part of a message" (Schrader, 1990, p. 12). Was there evidence of periods, question marks, or quotation marks used in their sentences? Were there other punctuation marks used to assist with their written meaning?

Using these descriptors the artifacts were examined and coded. The artifacts were also grouped by the medium the children had used.

Findings

Based upon the results of the coding, the work of four children provided the data for the following discussion. These four children were the most consistent in their compositions, and had composed several artifacts in both mediums. The other children in the study rarely wrote text without a lot of adult support, their writing was still mostly pictorial and did not provide the type of writing examined in Clay's concepts. The artifacts of each child were examined and sorted allowing the creation of the following tables to look at how the children understood the concepts and principles of print in both mediums.

Table 1: Jessy's demonstrated understanding of the principles and concepts in these samples looks like this:

Principles/Concept	Traditional	Computer	Both
Flexibility	X	X	X
Generating	X	X	X
Sign	X	X	X
Recurring		X	
Inventory			
Directional	X		
Arrangement	X	X	X
Space		X	
Word	X	X	X

There are three areas in which Jessy does not demonstrate understanding in when using both mediums. One of these was directionality. Jessy had written with the computer only using programs that controlled the directionality, so she did not have to make choices. Jessy explored the recurring principle when working with the multimedia authoring programs. Jessy's traditional writing was in place to such a degree that she no longer explored with the understandings of letter shapes repeating or letter sounds being repeated to created new understandings. The third area of difference was that of spacing. From the beginning of the study Jessy consistently used spaces between words when writing at the computer but rarely spaced when she wrote with traditional materials.

Table 2: Paul's demonstrated understanding of the principles and concepts in these samples looks like this:

Principles/Concept	Traditional	Computer	Both
Flexibility	X	X	X
Generating	X	X	X
Sign	X	X	X
Recurring			
Inventory			
Directional	X		
Arrangement	X		
Space		X	
Word	X	X	X

There are three areas that Paul does not demonstrate understanding in when using both mediums. The samples available for analysis impacted two of these areas, directionality and arrangement. Paul had written with the computer only using programs that controlled the directionality and page arrangement. Paul had done no writing where he had to make choices at the computer as he had with traditional writing. The third area of difference was that of spacing. Paul had begun to insert spaces into his computer writing but had not transferred this concept to his handwriting.

Table 3: Sarah's demonstrated understanding of the principles and concepts in these samples looks like this:

Principles/Concept	Traditional	Computer	Both
Flexibility	X	X	X
Generating	X	X	X
Sign	X	X	X
Recurring			
Inventory			
Directional	X		
Arrangement	X		
Space		X	X
Word	X	X	X

There are three areas in which Sarah does not demonstrate understanding when using both mediums. The samples available for analysis impacted two of these areas, directionality and arrangement. Sarah had written with the computer only using programs that controlled the directionality and page arrangement, she had done no writing where she had to make choices at the computer as she had with traditional writing. The third area of difference was that of spacing. Sarah consistently inserted spaces between words when writing with the computer but had not transferred this concept to her handwriting.

Table 4: Comparing Sammy's demonstrated understandings of the principles and concepts in these samples looks like this:

Principles/Concept	Traditional	Computer	Both
Flexibility	X	X	X
Generating	X	X	X
Sign	X	X	X
Recurring			
Inventory			
Directional	X		
Arrangement	X		
Space		X	
Word	X	X	X

There are three areas that Sammy does not demonstrate understanding in when using both mediums. The samples available for analysis impacted two of these areas, directionality and arrangement. Sammy had written with the computer only using programs that controlled the directionality and page arrangement. He not written with programs where he had to make choices at the computer like those he made with traditional writing. The third area of difference was that of spacing. Sammy consistently, from the beginning of the study, inserted spaces between words in his computer writing but had not transferred this concept to his handwriting.

Conclusions

For these four children the major difference in their demonstrated understandings was in their understanding to use space as a boundary around words. None of these children consistently used spaces in their traditional writing, yet all of the children used spaces in their computer writing. I did not discuss the issue of spacing between words with the children individually. I did not deliberately teach them how to space between words in their traditional writing. Somehow, they had constructed this knowledge at the computer, and I wanted them to be able to construct this knowledge, on their own, in their traditional writing. The last day of school, I discussed the writings and the issue of spacing with these four children. I reminded Paul about what he had discovered when he typed the email message to his father he replied, "Move the letters so you'll know what I'm writing. (He was moving his hand up and down like he was pushing keys)." I showed the children samples of their computer written messages. We discussed the spaces between the words that they all had inserted. We even discussed their use of the space bar more than once between words. We discussed their traditional writing and looked at the spaces between words. We looked closely at the Jessy's hand written piece for Mr. Muller's book that had no spacing between the words. "What about the spacing between the words in this piece?" I asked. Sammy was the only one to talk during this section. He was certain that there *was* extra spacing between the words. The other children simply nodded with him in agreement. These were normally talkative children just looked at me, appearing as perplexed by my questioning their lack of space boundaries, as I was with what I felt was their inability to see the space around their words was missing. They understood that there was extra space between their words. It became an issue of perception of "what is spacing" and the individual interpretation of space.

The study has led me to believe that what we expect of individual children as they write at the computers needs to vary from child to child. The expectations for what they produce at the table become different from what I expect them to produce at the computer. When observing and assisting Jessy at the computer it was my expectation that she would space between her words and she might be reminded if she forgot. However, this issue of spacing with her handwriting would not be expected, it would be scaffolded toward later mastery. Similar expectations would be made for each of the children.

When working with young children at the computer individual differences need to be allowed for. These differences can lead toward the child functioning at a different, frequently higher, level than they do with their traditional writing. As the teachers of these emergent writers, we need to support their writing in multiple ways. The use of technology to write provides yet another way to scaffold their development.

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